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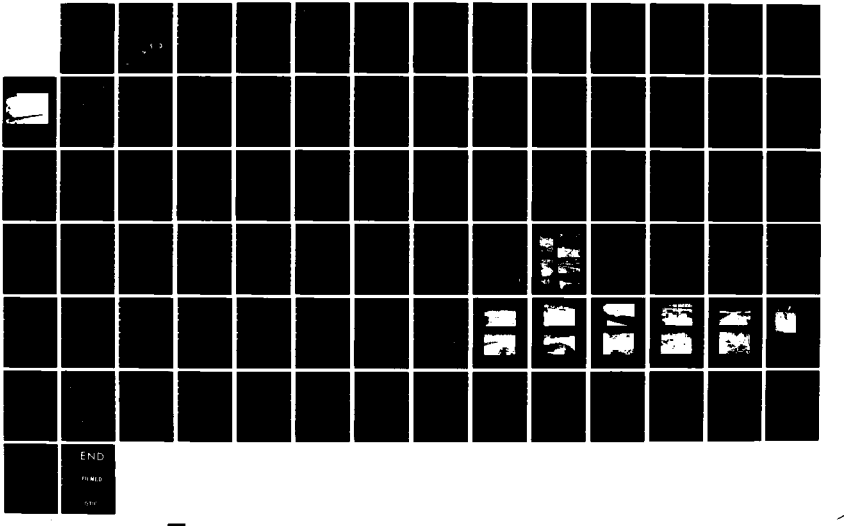

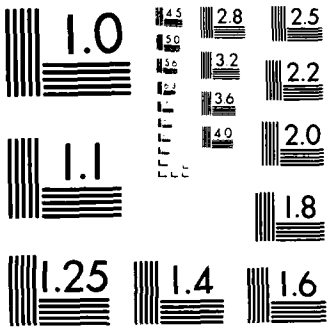

PAWTUXET RIVER BASIN
GLOCESTER, RHODE ISLAND

'ONAGANSET RESERVOIR DAM
RI 01304

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

MARCH 1980

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER RI 01304	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Ponaganset Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE March 1980 13. NUMBER OF PAGES 47
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Pawtuxet River Basin
Glocester, Rhode Island
Ponaganset River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

THe dam is an earth embankment dam constructed around 1885. It is 26 ft. high and about 635 ft. long. The dam is considered to be in fair condition. It is intermediate in size with a significant hazard potential. There are various remedial measures which must be undertaken by the owner.

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
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REPLY TO
ATTENTION OF
NEDED

JUN 03 1980

Honorable J. Joseph Garrahy
Governor of the State of Rhode Island
and Providence Plantations
State House
Providence, Rhode Island 02903

Dear Governor Garrahy.

Inclosed is a copy of the Ponaganset Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Management, the cooperating agency for the State of Rhode Island. In addition, a copy of the report has also been furnished the owner, City of Providence, Rhode Island.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Management for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

PONAGANSET RESERVOIR DAM

RI 01304

PAWTUXET RIVER BASIN

GLOCESTER, RHODE ISLAND

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

IDENTIFICATION NO.:	RI 01304
NAME OF DAM:	Ponaganset Reservoir Dam
TOWN:	Glocester
COUNTY AND STATE:	Providence County, Rhode Island
STREAM:	Ponaganset River
DATE:	10 October 1979

BRIEF ASSESSMENT

The Ponaganset Reservoir Dam is an earth embankment dam constructed around 1885. The dam has a maximum height of 26 feet and is approximately 635 feet long. Typical embankment slopes are 1V on 2H on the downstream face and 1V on 1.5H on the upstream face. George Allen Road traverses the length of the dam crest. The downstream face is covered with heavy brush, trees, and tree stumps, while the upstream slope above the water level is covered with intermittent riprap and overgrown with grass and brush. The overflow spillway is a double barrel reinforced concrete box culvert located at the right abutment of the dam. The spillway intake apron is paved with a stone masonry bottom and riprap sides. The discharge channel consists of a natural unlined channel which traverses the toe of the dam and joins the Ponaganset River approximately 200 feet downstream from the dam. The outlet works is a gated 24-inch diameter conduit through the dam.

Based on the visual inspection at the site and the lack of engineering data available, there are areas of concern which should be corrected. The dam is considered to be in FAIR condition. There is evidence of recent clearing of vegetation on the slopes, however, the dam embankment has received limited regular maintenance. Several rotting stumps are located on the downstream slope at either side of the outlet pipe and appear to be the cause of several seepage pools along the toe of the dam. A relatively new concrete pier which supports the gate mechanisms is cracked, and the outlet pipe is leaking. Both discharge channels for the outlet spillway and outlet conduits are heavily overgrown with brush and small diameter trees and are unlined and subject to erosion.

The dam is classified as INTERMEDIATE in size and a SIGNIFICANT hazard structure in accordance with recommended guidelines established by the Corps of Engineers. Based on the size and hazard classifications, the test flood for this structure ranges from one-half Probable Maximum Flood (PMF) to the full PMF. One-half PMF was adopted as the test flood for Ponaganset Reservoir Dam. The existing spillway capacity is equal to 130 CFS which represents more than 107 percent of the test flood outflow of 122 CFS. Overtopping, assuming stillwater conditions, would not occur.

It is recommended that the Owner engage the services of an engineer experienced in the design of dams to accomplish the following: investigate the seepage along the downstream toe of the dam; remove the rotting tree stumps and backfill the root depressions with appropriate soils; investigate the capacity of the downstream discharge channels; recommend measures to prevent erosion of the downstream embankment slope from high stage spillway flows; replace riprap on the upstream face with appropriate stone to prevent wave erosion; evaluate the cracking of the concrete pier which supports the sluice gate mechanism and recommend corrective measures for its rehabilitation; investigate the inability to close the outlet works.

The above recommendations and other remedial measures as described in Section 7 should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

CE MAGUIRE, INC.

Richard W. Long

Richard W. Long, P.E.
Vice President

RICHARD W. LONG
No. 3529
REGISTERED
PROFESSIONAL ENGINEER

This Phase I Inspection Report on Ponaganset Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that an unsafe condition be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff) or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General The water level for Ponaganset Reservoir Dam is generally uncontrolled. It is normal operating procedure to allow all discharges to pass over the uncontrolled spillway into Ponaganset River and flow downstream. During periods of excessive rain and high reservoir storage the outlet works is opened and the reservoir is allowed to partially drain. During extended periods of drought water is allowed to drain through the outlet to provide a supplemental water supply for the Scituate Water Supply system.

Generally, water level elevations are taken weekly by members of the Providence Water Supply staff. Operating procedures as a rule are not varied except for critical situations. All operating personnel including the engineering and forestry staff are placed on call. Release of water downstream would be contingent on downstream conditions, reservoir levels, and expected storm impact on the impoundment.

b. Description of Any Warning System in Effect
During high reservoir stages and approaching storm activity, key personnel are placed on 24-hour alert as required. Storm activity is monitored by local weather forecasts or by direct communications with the U.S. Weather Service. Operating and engineering staff members who are placed on call have the capability of operating any equipment necessary, so assignments under critical conditions are not selective. No formal Emergency Action Plan regarding authorities to be contacted or expedient action to be taken to lessen the impact of the dam failure on downstream areas is in effect.

4.2 Maintenance Procedures

a. General As discussed in Section 3 of this report, the embankments and downstream channel are overgrown extensively. The vegetation was sprayed with defoliant prior to the visual inspection, but not cleared; and the rehabilitation of the roadway and its drainage system was under construction. It appears that the maintenance at the damsite is intermittent and limited and accomplished when staff resources permit and not on a regular basis.

b. Operating Facilities Operational tests of the outlet works gates are not performed. Rather, the gates are exercised when the pool requires regulation, which has been infrequent recently.

The downstream face and discharge channel should be cleared of vegetation and stumps.

The source of seepage at the downstream face between Sta 0+90 and Sta 3+00 should be investigated and monitored for changes in quantity and quality. The cause of the large crack and settlement in the control gate pier should be investigated and corrective measures implemented. The cause of the leaking control gate should be determined and eliminated.

Rehabilitation of the George Allen roadway surface by the Town of Glocester and the Providence Water Supply Board should be completed or the roadway temporarily protected until spring runoff has occurred and then completed. Removal of the abandoned bridge abutments downstream of the outlet works should also be considered.

toe of the dam between the stumps at Sta 0+90 and Sta 3+00. (See Photos C-3, C-11).

c. Appurtenant Structures.

1. Spillway - The general configuration of the spillway is shown in Photo C-7 and is located at approximately Sta 5+45. The spillway consists of twin 36" H x 48" W reinforced concrete box culverts. The training walls for both the approach channel and discharge channel are riprap covered earth slopes with stone masonry bottoms. Some small brush is growing within the riprap.

2. Outlet Works - The outlet works at Ponaganset Reservoir is located at Sta 1+55 and consists of a 24-inch cast iron pipe and sluice gate. A concrete pier structure supports the gate mechanism and provides access to the gate from the crest of the dam. The gate mechanism is enclosed within a removable steel locker which provides protection from vandalism. The concrete pier which supports the gate mechanism is cracked and appears to be settling. The gate mechanism was not operated at the time of inspection: The outlet works is leaking, and discussions with the Providence Water Supply Board personnel indicate that the settlement of the pier and leaking outlet pipe may be connected. (See Photos C-5, C-6).

d. Reservoir Area. No specific detrimental features in the reservoir area were observed during the visual inspection of the dam. The slopes and banks of the reservoir appear to be well-covered with vegetation. See the overview photograph and Photo C-9 for typical views of the reservoir area.

e. Downstream Channel. The downstream channel configurations for both the spillway and outlet works are delineated on sketches included in the Appendix of this report. The spillway discharge channel flows parallel with the toe of the dam and intersects the outlet works discharge channel approximately 200 feet downstream of the outlet headwall. Both discharge channels have natural earth sides with cobble bottoms and are heavily overgrown with brush and small diameter trees. Discharges from the outlet works conduit flow downstream between the abutments of an abandoned bridge, approximately 7 feet in width.

3.2 Evaluation

Based on visual inspection, the dam appears to be in FAIR condition, with several areas that require attention.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The phase I inspection of the dam at Ponaganset Reservoir was performed on October 30, 1979 by representatives of CE Maguire, Inc., and Geotechnical Engineers. The inspection team was accompanied in the field by Mr. E. Bondereski, Principal Engineer for the Water Supply Board operating staff.

Based on the visual inspection and review of available records and drawings, the condition of the dam at Ponaganset Reservoir is considered FAIR.

b. Dam. The dam is an earth embankment structure approximately 635 feet long and 26 feet high, with an average crest width of 24 feet. No construction drawings are available, but several plans showing subsequent repair are included in Appendix B. The original spillway was enlarged, and the existing gate mechanism and concrete support pier were added to the original dam at a later date.

1. Crest - The crest of the dam is approximately 24 feet wide and supports George Allen Road. The pavement of George Allen Road is in need of repair and some erosion of the crest at the edges of pavement has occurred. The guardrail system which consists of steel post and strung cable is also in need of repair and appears inadequate for present day conditions. Presently the Water Supply Board has added a new catch basin at the edge of the road near the outlet works gate mechanism. In addition, the Providence Water Supply Board has designed, but not constructed, an asphalt berm drainage ditch for George Allen Road to reduce the amount of erosion to the crest of the dam from roadway runoff. (See Photo C-4)

2. Upstream Slope - The upstream face was stone armored from an undetermined depth below the water surface to the crest with small cobbles and, in some locations, needs reshaping. Much of the embankment is covered with light brush. (See Photos C-1, C-2).

3. Downstream - The downstream face of the dam is typically 1V on 2H and is covered extensively with vegetation which had been sprayed with a defoliant previous to the inspection. Several large tree stumps were found on the embankment. Two large seepage pools were located at the

SECTION 2

ENGINEERING DATA

2.1 Design Data

No design data is available for this dam.

2.2 Construction Data

There are no available records of the construction of this dam. Several documents pertaining to repair work since 1917 are available. These documents consist of correspondence and visual inspection reports. A spillway repair plan, dated April, 1928, and a topo plan dated January, 1922, as well as other selected inspection reports, have been included in Appendix B of this report.

2.3 Operation Data

No record of operation for this facility has been maintained. Water surface levels are recorded weekly and are used to estimate available storage. This information is also published in the annual reports issued by the Providence Water Supply Board.

2.4 Evaluation of Data

a. Availability. The information noted above for this facility is available in the files of the Department of Environmental Management, State of Rhode Island, or the offices of the Providence Water Supply Board, Providence, Rhode Island.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspections, past performance, and sound engineering judgment.

c. Validity. No conflicts have been noted between available data and the observations made during the inspection, but all information must be verified.

4.	Gates	N/A
5.	U/S Channel	Natural bed; riprap side slopes
6.	D/S Channel	Unlined natural channel

j. Regulating Outlet
Refer to Paragraph 1.2b, "Description of Dam and Appurtenances", for description of outlet works.

1.	Invert (downstream)	615.6
2.	Size	24-inch diameter
3.	Description	Cast iron pipe
4.	Control mechanism	Manually operated sluice gate with protective steel enclosure on concrete pier.

f. Reservoir Surface. (Acres)

1.	Top of Dam	230
2.	Test flood pool	230
3.	Flood control pool	N/A
4.	Recreation pool	N/A
5.	Spillway crest	230

g. Dam

1.	Type	Earth embankment
2.	Length (including spillway culvert)	635 feet
3.	Height	26 feet
4.	Top width	24 feet
5.	Side slopes	Upstream 1V on 1.5H Downstream 1V on 2H
6.	Zoning	Unknown
7.	Impervious core	Unknown
8.	Cutoff	Unknown
9.	Grout curtain	Unknown

h. Diversion and Regulating Tunnel

1. N/A

i. Spillway

1.	Type	Uncontrolled, double barrelled reinforced concrete box culvert two 4 ft.W x 3 ft.H
2.	Length of weir	8 feet
3.	Crest elevation	635.4

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Ponaganset Reservoir Dam, constructed in 1865 for the Ponaganset Reservoir Company, a textile mill, is located on the Ponaganset River within the headwaters of the Pawtuxet River Basin.

The dam has a drainage area of 2.10 square miles and is located 2,500 feet north of Route 101. The basin has moderate slopes with approximately 10 percent of its area covered with swamps. The shape, slope, time of concentration, and other physical features of the basin indicate that a low value of the runoff should be expected. There is no gaging station within the watershed. This reservoir has a large storage capacity (2277 Ac.-Ft. at the spillway crest level) and also a large surface area (230 acres). Consequently, a test flood equal to one-half the PMF can be contained within the surcharge storage without overtopping the dam.

This dam has a spillway length of 8.0 feet in the shape of twin box culverts and a surcharge height of 6.0 feet between the top of the dam and the culvert inverts. The reservoir can accommodate 20.33 inches of runoff from the catchment area of 2.10 square miles. Every foot of depth in the reservoir above the spillway crest can accommodate 230 Ac.-Ft. of water equivalent to 2.05 inches of runoff.

Because there is 1380 Ac.-Ft., equivalent to 12.30 inches of runoff available in surcharge storage, this dam is basically considered a large storage facility. The maximum spillway capacity of 130 CFS which is 107 percent of the test flood outflow makes this reservoir a low spillage facility. Because the dam is an earth embankment it is less stable against overtopping due to erosion than other types of dams.

5.2 Design Data

No specific design data is available for this watershed. In lieu of existing design information, U.S.G.S. topographic maps (Scale 1" = 2,000') were utilized to develop hydrologic parameters such as drainage area, reservoir surface area, basin slopes, time of concentration and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. Surcharge storage was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic design

1.3 Pertinent Data

a. Drainage Area. Ponaganset Reservoir is located in Providence County in north-western Rhode Island. The basin is generally circular with an average length of 1.5 miles and a total drainage area of 2.1 square miles. (See Drainage Map in Appendix D). The topography is rolling terrain with elevations ranging from a high of 804 feet (National Geodedic Vertical Datum) NGVD to 635.4 feet at the spillway crest. Basin slopes are flat to moderate with grades of .01 to .03 feet/feet. The average time of concentration for the entire drainage basin is estimated to be 40 minutes.

b. Discharge at Damsite. There is limited discharge data available for this dam. Estimated extreme freshet recorded in the files of the Rhode Island Department of Environmental Management for this dam is equal to 297 CFS.

Listed below are other discharge data for spillway and outlet works:

1. Outlet Works:

Conduit Size - 24-inch diameter C.I. invert elevation 615.6

i. Discharge Capacity = 70 CFS at Spillway Crest Elevation 635.4

ii. Discharge Capacity = 80 CFS at Top of Dam Elevation 641.4

iii. Discharge Capacity = 79 CFS at Test Flood Elevation 640.9

2.	Maximum known flood at damsite	Unknown
3.	Ungated spillway capacity at top of dam	130 cfs
4.	Total discharge capacity at top of dam (Spillway plus outlet works)	210cfs
5.	Total project Discharge at test flood level	201 cfs

c. Elevations. (Feet above National Geodetic Vertical Datum, NGVD). (It should be noted that an apparent discrepancy of approximately 11.0 feet exists between elevations published by the U.S. Geological Survey and the Owner of the dam (Providence Water Supply Board).

1.	Streambed at toe of dam	617.6

g. Purpose of Dam. The Ponaganset Reservoir is a tributary reservoir to the main Scituate Reservoir located at Gainer Dam in Scituate, Rhode Island, which provides a water supply to approximately 33 percent of the State of Rhode Island and has a gross storage of 41,270 MG.

h. Design and Construction History. Ponaganset Reservoir was reportedly constructed about 1865. A limited amount of information is available regarding the early history of this facility. In December, 1917, the City of Providence acquired all lands, water, and flowage rights under Chapter 1278 of the Public Laws of 1915 which established the Providence Water Supply Board.

Records indicate that on July 21, 1926, the Reservoir was drained and the amount of storage reduced to 49 million gallons until October 24, 1942, when a new draw-off gate was installed. During this low-water period, in 1928, the existing spillway was installed. In 1964, the water level was again lowered and the outlet works' control gate refurbished. A removable steel enclosure, which provides protection from vandalism for the gate mechanism, was also installed at that time. The upstream and downstream faces of the dam were cleared of vegetation and a new gravel access road and guard rail system provided. An inspection of the dam in 1964 indicated that seepage was emerging at the western abutment of the dam. The report of this inspection further stated that placement of an upstream impervious soil blanket could be resorted to, but was not considered warranted at the time. No other construction records have been maintained.

i. Normal Operational Procedures - As a general rule, the outlet works at Ponaganset Reservoir remains closed and all flows are discharged to the lower Scituate Reservoir through the overflow spillway. During periods of excessive rainfall or extended drought, the Ponaganset supply may be lowered by use of the outlet conduit to relieve loading against the embankment structure or to supplement the Scituate impoundment. In recent years, this practice has not been warranted. During periods of intense rainfall, the dam and its appurtenances are inspected daily, but as a general rule, inspections occur on a weekly basis for all headwater reservoirs of the Scituate Reservoir system.

Maintenance of the facilities is scheduled on an as-needed basis due mainly to the extensive facilities to be managed and the limited operational staff available. Repair and rehabilitation of the operating equipment have been maintained, while brush and tree removal from the dam and its appurtenances has been intermittent.

b. Description of Dam and Appurtenances. The Ponaganset Reservoir Dam is an earth embankment structure approximately 635 feet long. The maximum height of the dam at the outlet works is about 26 feet. The slopes of the dam vary, but typically are 3H to 1V on the upstream face and 2H to 1V on the downstream slope. The outlet works for the dam is located near the left abutment, and is a gated, 24-inch cast iron pipe conduit through the dam controlled on the upstream face of the dam. The spillway is an uncontrolled, double barrelled reinforced concrete box culvert which permits flows to pass beneath George Allen Road.

c. Size Classification. Ponaganset Reservoir Dam has an impoundment capacity at the top of the dam (Elevation 639.0 NGVD) equal to 3657 Ac.-Ft. and a maximum height of 26 feet. Guidelines for the safety inspection of dams developed by the Corps of Engineers indicate that this dam be classified as INTERMEDIATE in size.

d. Hazard Classification. The dam is classified as having a SIGNIFICANT hazard potential because its failure may result in loss of life or property damage. Storage in this reservoir serves as a supplement to the water supply storage in the main Scituate Reservoir pool and constitutes approximately 2 percent of its total storage. Estimated downstream water depths due to a possible dam failure discharge of 22,000 CFS may range from 10.67 immediately downstream of the Ponaganset Reservoir Dam to 8 feet at a distance of 2,500 feet from the dam. The estimated rise in water surface elevation due to a dam failure of the Ponganset Reservoir Dam at Barden Reservoir, which is the next downstream reservoir in the Scituate Water System, will be approximately 6.0 feet. The failure of Ponaganset Reservoir Dam will result in the loss of George Allen Road and the utilities adjacent to the roadway; downstream flooding with high velocities; and the possible damage to Route 101 (Hartford Pike), Winsor Road, and one other unnamed downstream secondary road with the overhead utilities that are located within the rights of way for these roads. See Appendix D for additional dam failure analysis.

e. Ownership. The dam was originally built for the Ponaganset Reservoir Company (textile mill) around 1865 and purchased by its present Owner, the City of Providence, Rhode Island, in December, 1917.

f. Operator. Operations are conducted under the direct supervision of the Chief Engineer for the Providence Water Supply Board, located at 552 Academy Avenue, Providence, Rhode Island, 02903.

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

NAME OF DAM: PONAGANSET RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. CE Maguire, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to CE Maguire, Inc. under a letter from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-80-C-0013 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

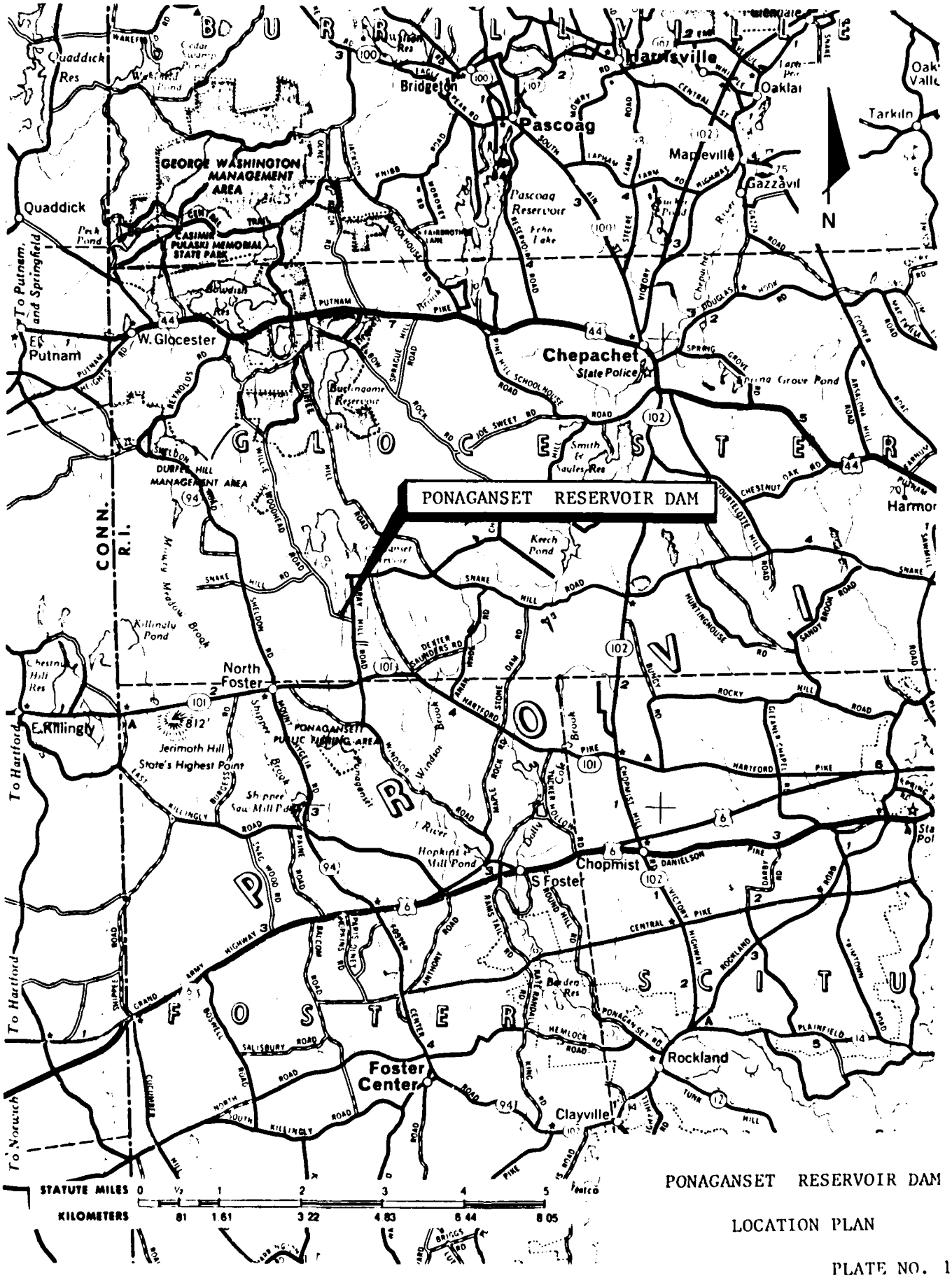
1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 Description of the Project

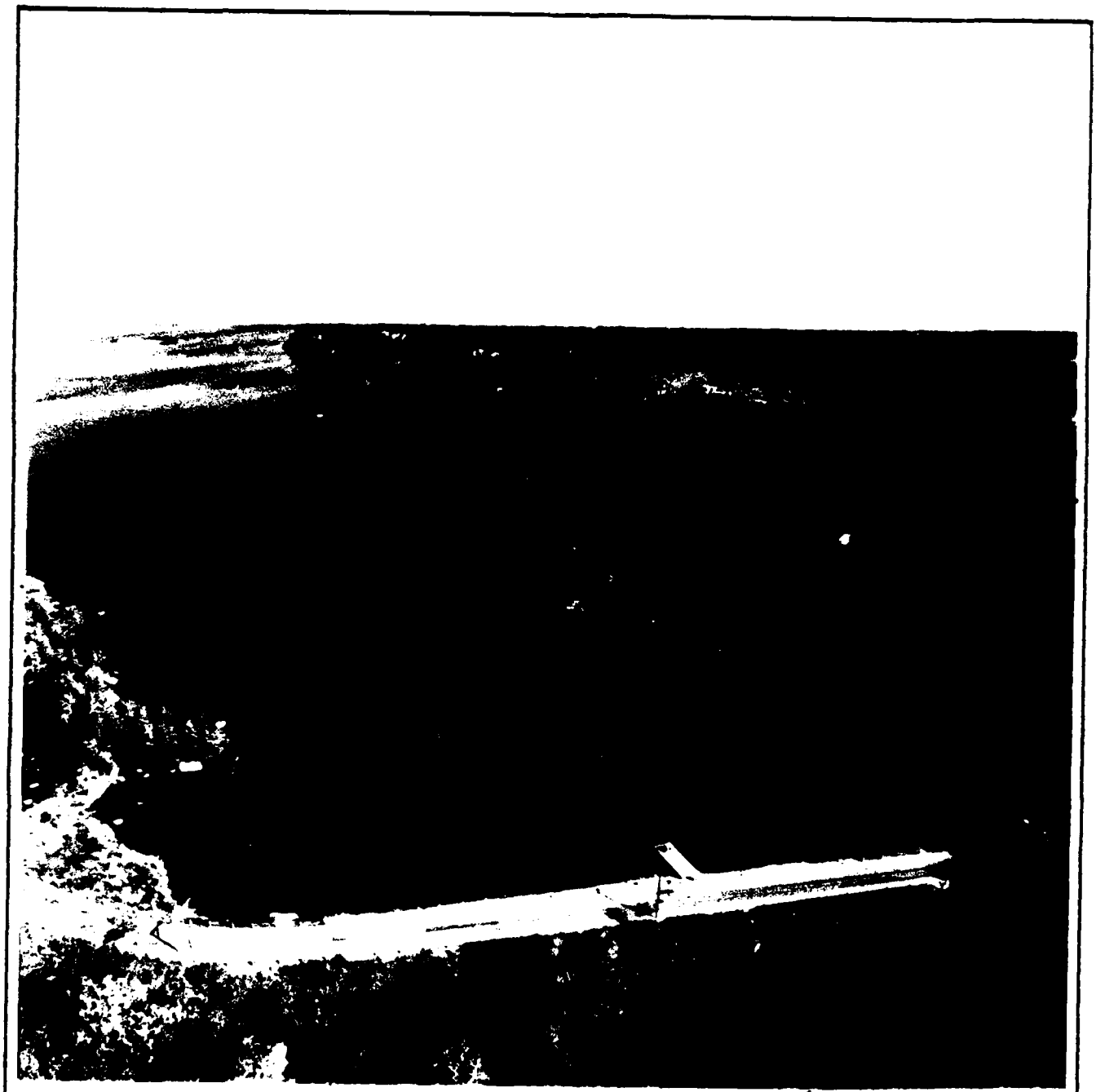
a. Location. Ponaganset Reservoir Dam is located in the Town of Glocester, Providence County, Rhode Island. Coordinates of the dam are approximately 41°52.1' N Latitude and 71°44.6' W Longitude. The dam impounds water from the Ponaganset River which drains a 2.1 square mile watershed of rolling terrain. The impoundment has a total surface area of 245 acres at the spillway crest level. The reservoir is aligned in a general north-south axis, with the dam located at the southern extremity.



PONAGANSET RESERVOIR DAM

LOCATION PLAN

PLATE NO. 1



OVERVIEW PHOTO - PONAGANSET RESERVOIR DAM

4.3 Evaluation.

Operations and maintenance procedures for this dam and its appurtenances appear to be infrequent and scheduled during periods of slack time for personnel. Maintenance of the facility is limited. An emergency action plan needs to be formulated and posted to insure proper and expedient action during critical periods.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Ponaganset Reservoir Dam, constructed in 1865 for the Ponaganset Reservoir Company, a textile mill, is located on the Ponaganset River within the headwaters of the Pawtuxet River Basin.

The dam has a drainage area of 2.10 square miles and is located 2,500 feet north of Route 101. The basin has moderate slopes with approximately 10 percent of its area covered with swamps. The shape, slope, time of concentration, and other physical features of the basin indicate that a low value of the runoff should be expected. There is no gaging station within the watershed. This reservoir has a large storage capacity (2277 Ac.-Ft. at the spillway crest level) and also a large surface area (230 acres). Consequently, a test flood equal to one-half the PMF can be contained within the surcharge storage without overtopping the dam.

This dam has a spillway length of 8.0 feet in the shape of twin box culverts and a surcharge height of 6.0 feet between the top of the dam and the culvert inverts. The reservoir can accommodate 20.33 inches of runoff from the catchment area of 2.10 square miles. Every foot of depth in the reservoir above the spillway crest can accommodate 230 Ac.-Ft. of water equivalent to 2.05 inches of runoff.

Because there is 1380 Ac.-Ft., equivalent to 12.30 inches of runoff available in surcharge storage, this dam is basically considered a large storage facility. The maximum spillway capacity of 130 CFS which is 100 percent of the test flood outflow makes this reservoir a low spillage facility. Because the dam is an earth embankment it is less stable against overtopping due to erosion than other types of dams.

5.2 Design Data

No specific design data is available for this watershed. In lieu of existing design information, U.S.G.S. topographic maps (Scale 1" = 2,000') were utilized to develop hydrologic parameters such as drainage area, reservoir surface area, basin slopes, time of concentration and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. Surcharge storage was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic design

data was obtained and/or confirmed by actual field measurements at the time of the visual field inspection.

The test flood inflow/outflow values and dam failure profiles were determined in accordance with the Corps of Engineers guidelines. Final values in this report are quite approximate and are no substitute for actual detailed analyses.

5.3 Experience Data

No continuous historical data for recorded discharges or water surface elevations is available for this dam.

5.4 Test Flood Analysis

Recommended guidelines for the Safety Inspection of Dams by the Corps of Engineers were used for selection of the "Test Flood". This dam is classified under those guidelines as a SIGNIFICANT hazard and INTERMEDIATE in size. Guidelines indicate that one-half P.M.F. to the full P.M.F. be used as a range of test floods for such classifications. The watershed has a total drainage area of 2.10 square miles, of which 0.21 square miles (10 percent) is swampy or covered by natural storage reservoirs. This drainage area is sparsely populated, largely wooded, and is hilly with rolling terrain. The average basin slope is 0.01 to 0.03 feet/feet which is considered flat to moderate. A "test flood" equal to one-half P.M.F. was calculated to be 500 CSM, equal to 1050 CFS for a drainage area of 2.1 square miles. The outflow discharge for this test flood inflow was 122 CFS.

The spillway and outlet rating curves are illustrated in Appendix D. Flood routings were performed assuming a full reservoir which is the pool level at the spillway crest.

The spillway capacity is hydraulically adequate to pass the "test flood" outflow and would not overtop the dam. The inflow and outflow discharge values for this test flood are 1050 CFS and 122 CFS, respectively. The maximum outflow capacity of the spillway, in a still reservoir, without overtopping of the dam is 130 CFS which is 107 percent of the test flood outflow discharge.

At the spillway crest level (Elev. 635.4 feet), the capacity of the outlet structure is 70 CFS. It will require 39 hours to lower the reservoir level the first foot assuming a surface area of 230 acres. For the 2277 Ac.-Ft. of available storage below the spillway crest, it will require 33 days to drain this reservoir through the existing outlet. One foot of depth in the reservoir at the spillway crest can accommodate 2.05 inches of effective rainfall.

5.5 Dam Failure Analysis

An instantaneous full-depth/partial-width breach was assumed to have occurred in this dam. This will result in an unsteady flow phenomenon with one flood wave travelling up into the reservoir to feed the other wave travelling downstream into the valley.

The calculated dam failure discharge of 21,730 CFS, assuming impounded water level is at the top of the dam (Elev. 641.4), will produce an approximate water surface flood wave stage of 628.02 feet immediately downstream from the dam. This will raise the water surface 8.5 feet over and above the depth just prior to failure when the discharge is 130 CFS. The failure analysis of the dam covered the reach extending from the dam to 2500 feet downstream. Normal uniform flow, following Manning's formulae, will occur at that point with a depth of flow equal to 8.20 feet based on the assumption that the Route 101 bridge structure will withstand the wave impacts. For a distance of 2500 feet from the dam, the depth of flow will change from 10.67 feet to 8.20 feet. Failure discharge will diminish as the reservoir is emptied and depth decreased. River Valley storage and frictional losses will tend to greatly reduce the discharge and flow velocities. Water surface elevations due to failure of the dam are computed and are at Appendix D.

It is estimated that maximum depth of flow due to failure of this dam will be 10.67 feet and the maximum velocity 37.0 ft./sec.

An attempt was made to delineate the downstream impacted area resulting from the dam failure on topographic mapping published by the U.S. Geological Survey, using elevations derived from record drawings provided by the Owner (Providence Water Supply Board). However, this could not be accomplished because of an apparent discrepancy in grade of approximately 11 feet between the two sources of data. This discrepancy should be resolved. It is estimated that failure of the dam will result in the loss or damage to George Allen Road, Route 101 (Hartford Pike), Winsor Road and an unnamed secondary road. Utilities within the rights of way for these roadways will also be damaged and temporarily disrupted. Loss of a few lives may result.

As a result of the dam failure analysis, Ponaganset Dam was classified as a SIGNIFICANT hazard. (See Appendix D for more details).

The estimated rise in water surface elevation in Barden Reservoir due to the failure of Ponaganset Reservoir Dam will be approximately 6.0 $\pm$ feet.

PONAGANSET RESERVOIR DAM

Inflow, Outflow and Surcharge Data

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR** EFFECTIVE RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE HEIGHT IN FEET	SURCHARG STORAGE ELEVATIC
½ PMF = Test Flood	11.9	9.5	1,050	122	5.50	640.9

* Infiltration assumed as 0.1"/hour

** Lake assumed initially full at spillway crest elevation 635.4
(top of dam = 641.4)

NOTES:

1. PMF and "test flood" computation based on Corps of Engineers instructions and guidelines.

2. Maximum capacity of spillway without overtopping the top of the dam elevation (641.4) is equal to 130 CFS.

3. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.

4. Test flood = one-half PMF = 500 CSM = 1,050 CFS
(D.A. = 2.10 square miles).

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation. The visual observations did not disclose any evidence of present or past structural instability.

6.2 Design and Construction Data

No design or construction drawings or records for the embankment or spillway are available.

6.3 Post-Construction Changes

Modification to Ponaganset Reservoir Dam includes Spillway/ Culvert Rehabilitation (November 23, 1927; Revised April 25, 1928); and the modification on repair plain of the gatehouse structure (May 28, 1964).

6.4 Seismic Stability

The dam is located near the boundary between Seismic Zones 1 and 2, and in accordance with the recommended Phase I guidelines does not warrant seismic stability analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection indicated that the Ponaganset Reservoir Dam is in FAIR condition. The major concerns regarding the long-term performance of this dam include:

1. Vegetation on the embankments and discharge channels.

2. Seepage along the downstream embankment of the dam from Sta 0+90 through Sta 3+00.

3. Incomplete riprap protection on the upstream face.

4. Rotting tree stumps on the downstream embankment slopes.

5. Discharge of low level outlet into unlined channel directly at the toe of the embankment.

6. Discharge of the spillway culvert into an unlined channel which traverses the downstream toe of the dam.

7. Erosion of the dam crest due to runoff from George Allen Road.

8. Leakage and inability to seat the outlet works sluice gate.

9. The cracked concrete pier which supports the gate mechanism.

10. Constricting abutments just downstream from the dam causing a backwater condition.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data; but is based primarily on the visual inspection, past performance history, and sound engineering judgment.

c. Urgency. The recommendations and remedial measures described below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations

The following recommendations should be carried out under the direction of a qualified registered engineer:

1. Investigate the significance of the seepage along the downstream toe and recommend measures for monitoring the seepage and/or preventing piping of the embankment soils.

2. Investigate the capacity of the downstream spillway channel and recommend measures to prevent possible erosion of the toe area during high discharges.

3. Remove rotting stumps on downstream slope and backfill root depressions with appropriate soils.

4. Remove large trees growing on the upstream and downstream embankment slopes and evaluate techniques to properly backfill and compact the root cavities with appropriate soils.

5. Place riprap on upstream slope of embankment.

6. Investigate the requirements for channel and slope protection at the low level outlet and recommend measures for preventing scour and undermining of outlet pipe and embankment.

7. Investigate the operability of the sluice gate for the outlet works.

8. Evaluate the cause of the cracked concrete pier which supports the gate mechanism.

9. Complete the improvement to George Allen Road.

10. Resolve the differing elevations used by the Providence Water Supply Board on the reservoir documents and the published topography of the U.S. Coast and Geodetic Survey, as used on the Chepachet and Clayville Quadrangles. After resolvement of the discrepancy, re-evaluate the impact to downstream areas from a potential dam failure discharge by developing a downstream profile that will reflect the natural storage areas, flow restrictions and detailed topography.

11. Inspect the spillway under no flow conditions.

The Owner should implement any recommendations resulting from the above investigations.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

1. Clear brush, vines and small trees on the downstream and upstream slopes and downstream spillway channel.

2. Institute a program of annual technical inspection by qualified registered engineers.

3. Consider the removal of the abandoned stone abutments that constrict flow in the Ponoganset River immediately below the dam.

4. Develop an "Emergency Action Plan" that will include an effective preplanned warning system, action to be taken at other reservoirs, locations of emergency equipment, material and manpower, authorities to be contacted, potential areas that require warning and/or evacuation and reservoir dewatering procedures. The Owner should also provide surveillance of the dam during intense rainfalls.

7.4 Alternatives

The are no recommended alternatives to the recommendations discussed above.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

TIME 11:30 A.M.

WEATHER Clear, 40's

W.S.ELEV. 635.9 U.S. _____ D.S.

PARTY :

1. A. Reed, CEM
2. L. Topp, CEM
3. E. Dessert, CEM
4. S. Khanna, CEM
5. F. Leathers, GEI
6. _____
7. _____
8. _____
9. _____
10. _____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	635.4
Current Pool Elevation	635.9
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	Fair - many small cracks, tire ruts, frequent patched potholes
Movement or Settlement of Crest	Too irregular to judge
Lateral Movement	Too irregular to judge
Vertical Alignment	Too irregular to judge
Horizontal Alignment	Too irregular to judge
Condition at Abutment and at Concrete Structures	Slight erosion next to low level gate structure, roadway drainage outlet
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Free access; no significant signs of trespass
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	Riprap non-existent on most of upstream face
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	Seepage noted in toe area Sta. 0+90 to Sta. 3+00
Piping or Boils	None observed
Foundation or Drainage Features	None

PERIODIC INSPECTION CHECK LIST

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT (Cont.)	
Toe Drains	None
Instrumentation System	None
Vegetation	Downstream slope covered with heavy brush, vines and trees to 3-inches in diameter; also several rotted stumps to 30 inches in diameter. Upstream slope covered with brush, vines and several trees to 24 inches in diameter.

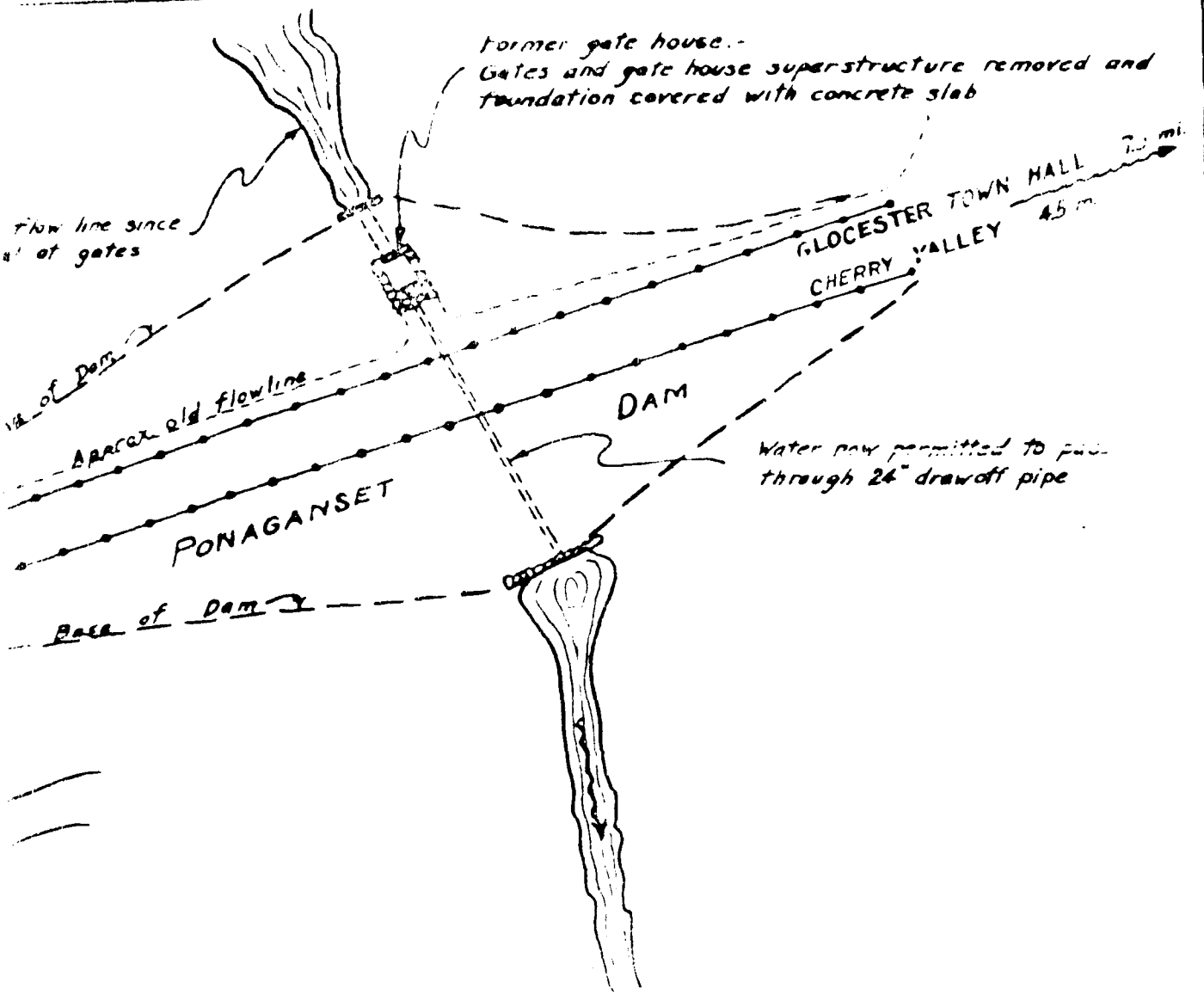
PERIODIC INSPECTION CHECK LIST

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	Underwater - could not be observed Large crack through concrete pier



CITY OF PROVIDENCE
DEPARTMENT OF PUBLIC WORKS
SCITUATE RESERVOIR DIVISION
PONAGANSET RESERVOIR DAM AND HIGHWAY
SCALE 1" = 40'
MARCH 15 1929

PHOTO REDUCED
... TO SCALE

Acc 52

PUNKANSET RESERVOIR BASIN

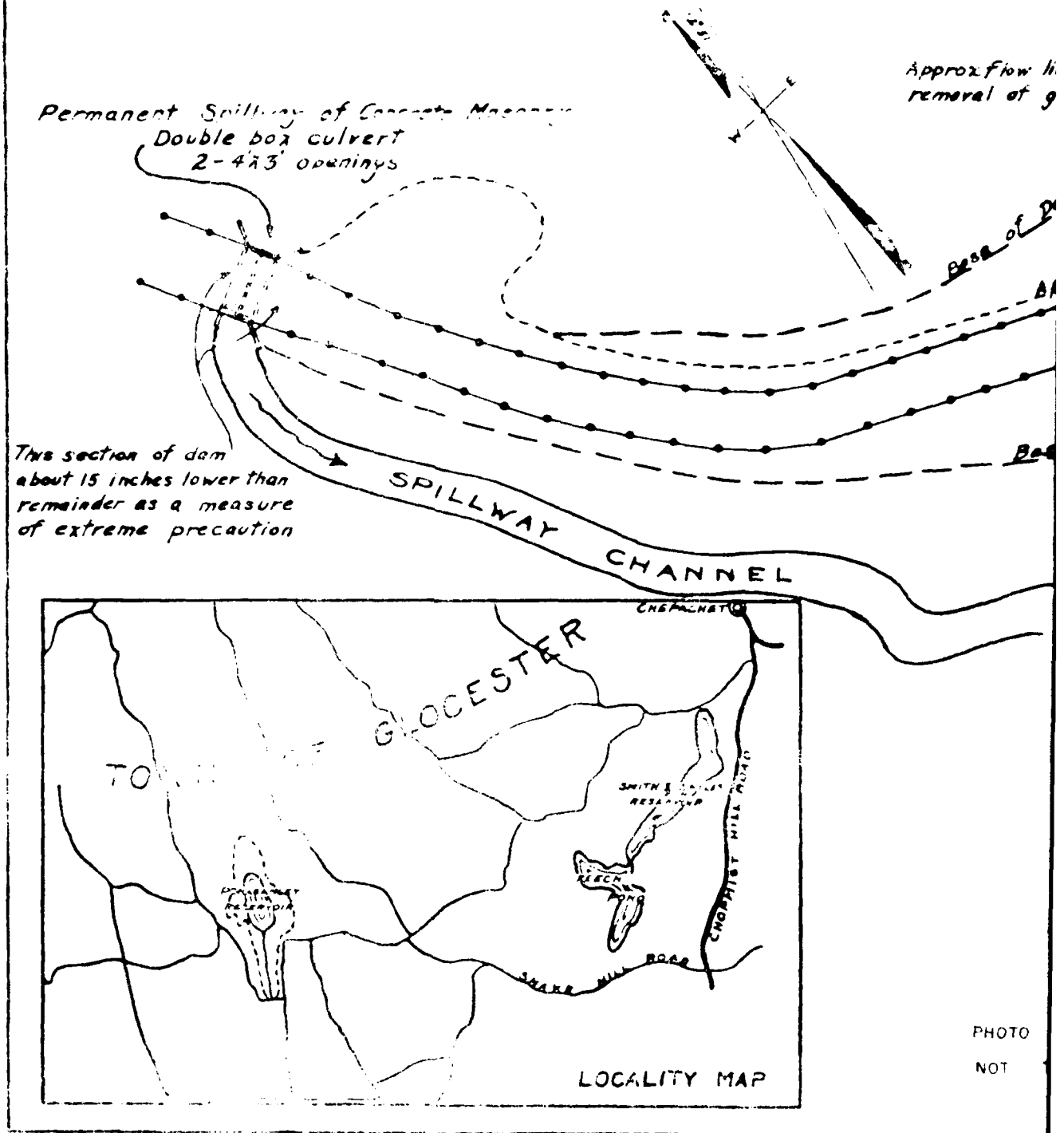
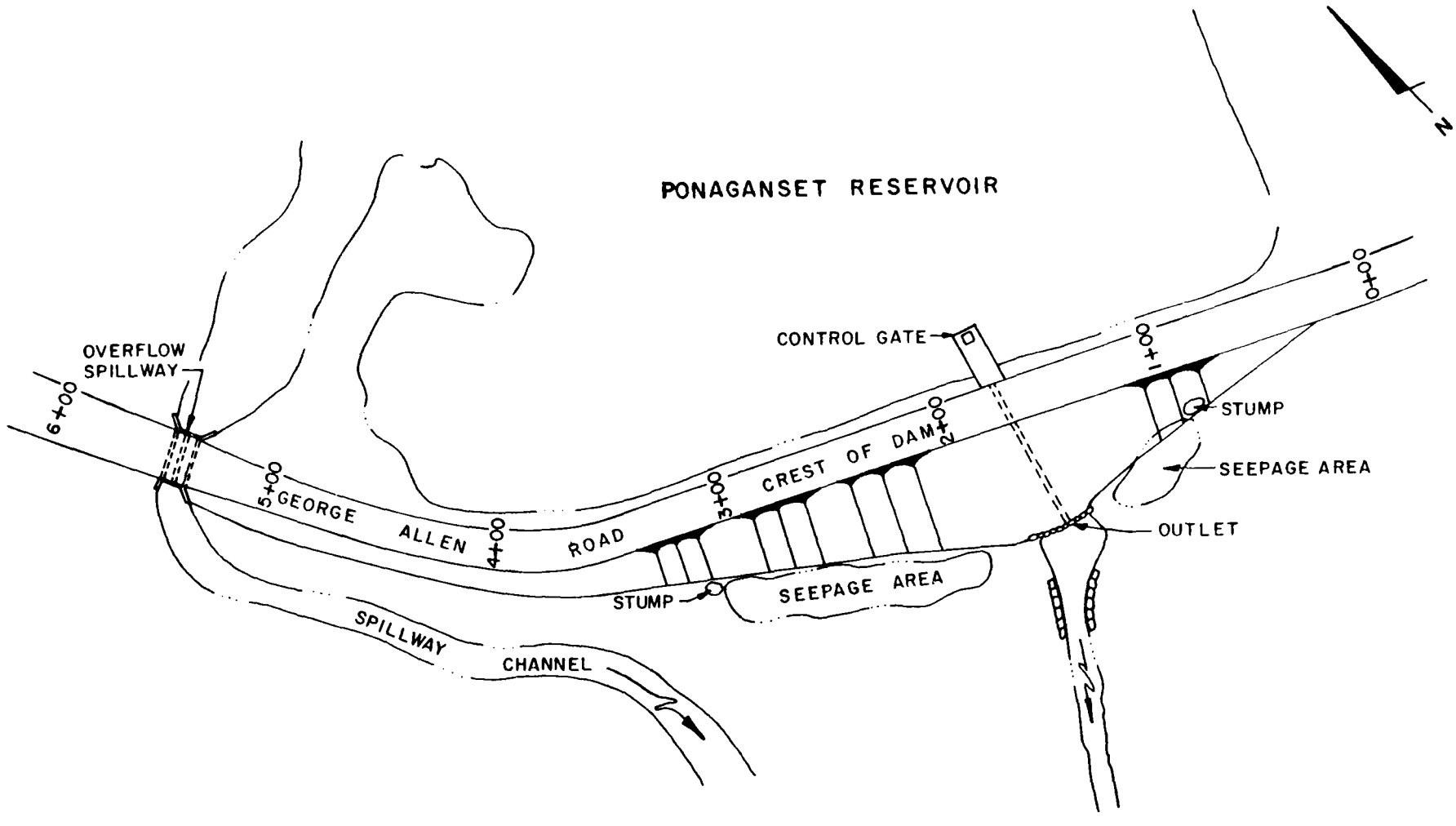


PHOTO
NOT

10/2



PLAN

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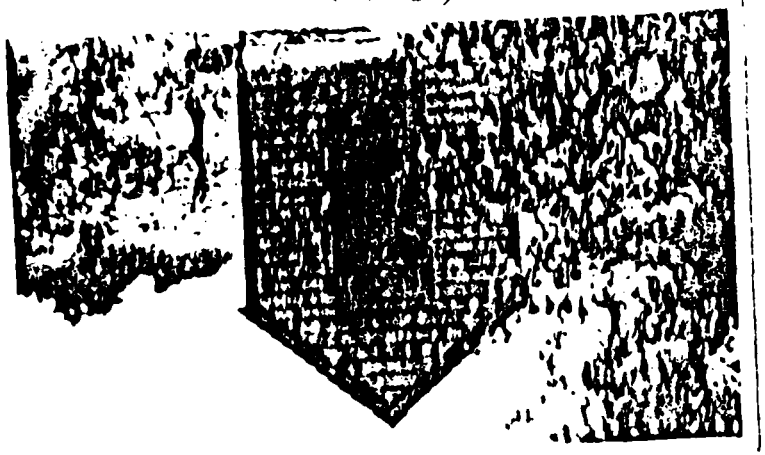
PONAGANSET RESERVOIR
GENERAL PLAN

APPENDIX B-3

PLANS, SECTIONS DETAILS

Gate House 1909

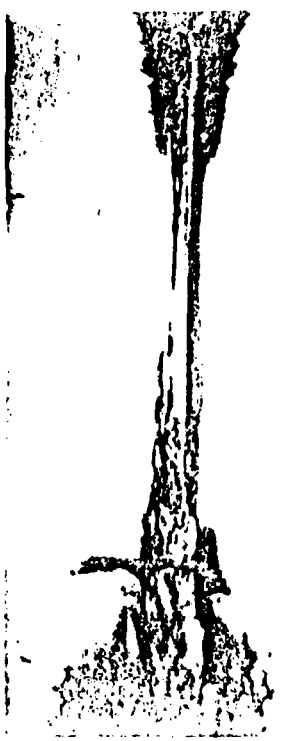


Gate 1909

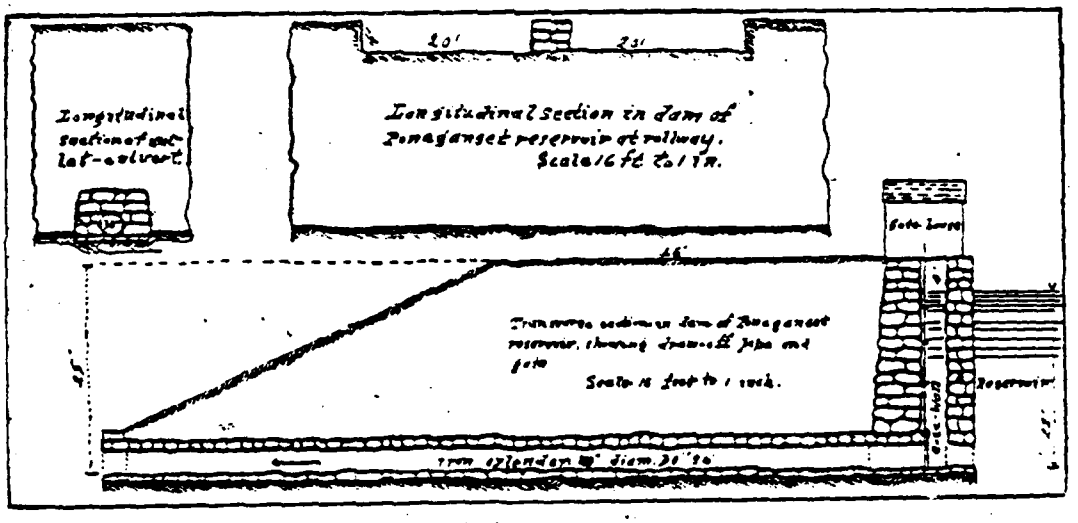
empty, 1909

May. 1910

1910



Pomeroy Res, empty 1909


Longitudinal section of cut-off-culvert
20'
23'
Longitudinal Section in dam of Ponaganset reservoir at railway.
Scale 16 ft to 1 in.
Gate House
Reservoir
Scale 16 feet to 1 inch.

Dam # 165

D-1-51.

DIVISION OF HARBORS AND RIVERS

SURVEY OF DAMS IN RHODE ISLAND

Pawtuxet River Basin (North Branch) #165 Ponagansett Res.

Drainage Area 2.2 sq. mi.

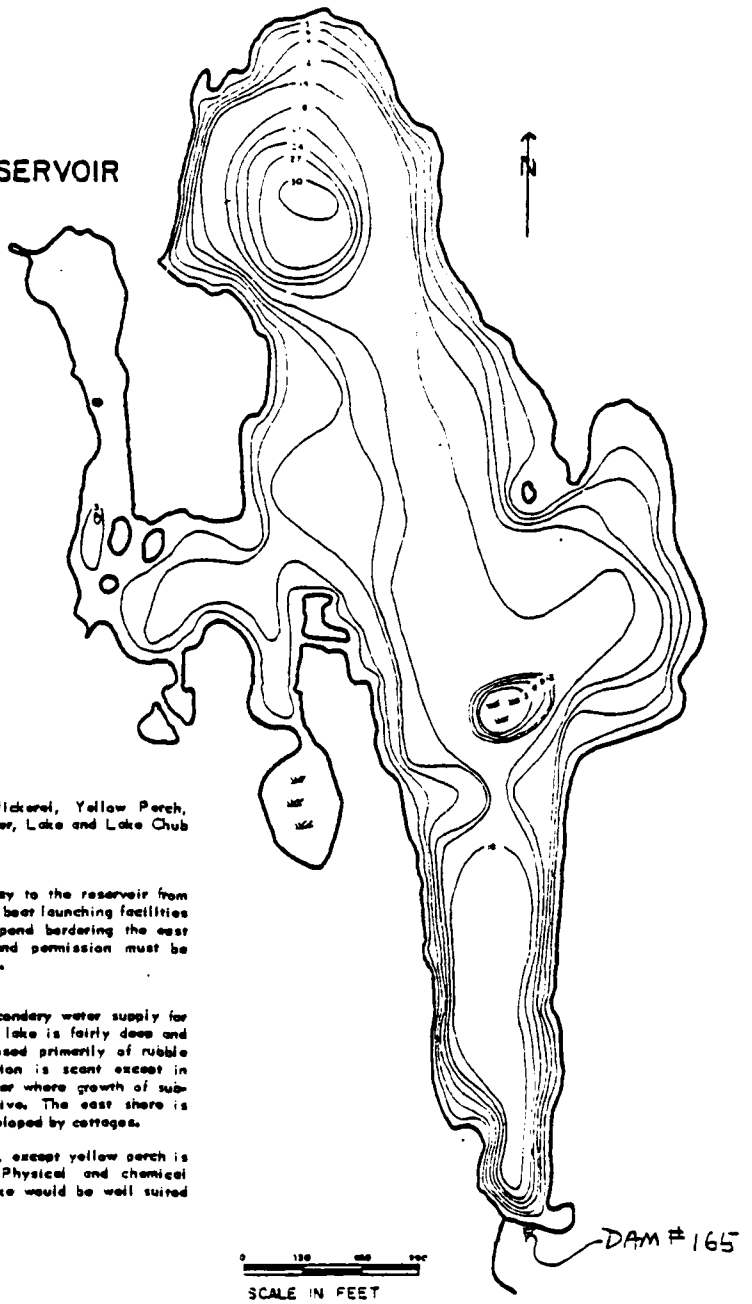
February 1948

Spillway

Estimated extreme freshet 297 c.f.s.

FEBRUARY 1948

PONAGANSET RESERVOIR
DAM #165



Town: Glocester

County: Providence

Physical Features: 223 Acres

Basin: Mon Mode

Maximum Depth: 31 Feet

Average Depth: 12 Feet

Known Fish Population:
Largemouth Bass, Chain Pickerel, Yellow Perch, Brown Bullhead, Golden Shiner, Lake and Lake Chub Sucker.

Accessibility:
There is a public right-of-way to the reservoir from Snake Hill Road. Parking and boat launching facilities are poor. A portion of the pond bordering the east shore is privately owned and permission must be obtained to fish in posted area.

General:
Ponaganset Reservoir is secondary water supply for the City of Providence. The lake is fairly deep and clear. The bottom is composed primarily of rubble and gravel. Aquatic vegetation is scant except in the shallow of the west finger where growth of submerged vegetation is extensive. The east shore is approximately 40 per cent developed by cottages.

Growth - game and pan fish, except yellow perch is below the state average. Physical and chemical features indicate that the lake would be well suited for smallmouth bass.

Date last surveyed:
August, 1961

APPENDIX B-2

Selected Copies of Past Inspection Reports

APPENDIX B-1

Correspondence pertaining to the history, maintenance, and modifications to the Barden Reservoir Dam as well as copies of past inspection reports are located at:

Department of Environmental Management
State of Rhode Island
83 Park Street
Providence, Rhode Island 02903

Providence Water Supply Board
552 Academy Avenue
Providence, Rhode Island 02903

APPENDIX B

ENGINEERING DATA

PERIODIC INSPECTION CHECK LIST

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (Cont.)	
Floor of Channel	Stone masonry bottom to 50 feet downstream; below 50 feet trapezoidal channel is lined with grass and leaves. Natural channel is formed by cobbles, boulders and possibly bedrock.
Other Obstructions	At some points, the downstream side slope of the natural channel is above the elevation of toe area, with only small berm preventing overflow into toe area.

PERIODIC INSPECTION CHECK LIST

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Spillway is approached by a short channel from cove at edge of reservoir
General Condition	Entrance to channel partially obstructed by boulders. Entrance to cove partially obstructed by island.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Brush and numerous trees to 3 inches diameter on island in cove entrance and around cove
Floor of Approach Channel	Channel lined with stone masonry
b. Weir and Training Walls	Twin opening, concrete box culvert
General Condition of Concrete	Good
Rust or Staining	None observed
Spalling	None observed
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	None observed
Drain Holes	N/A - no training walls
c. Discharge Channel	Trapezoidal unlined ditch leading to natural channel flowing down side hill to streambed at toe of dam
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Brush and small trees to 3-in. dia.

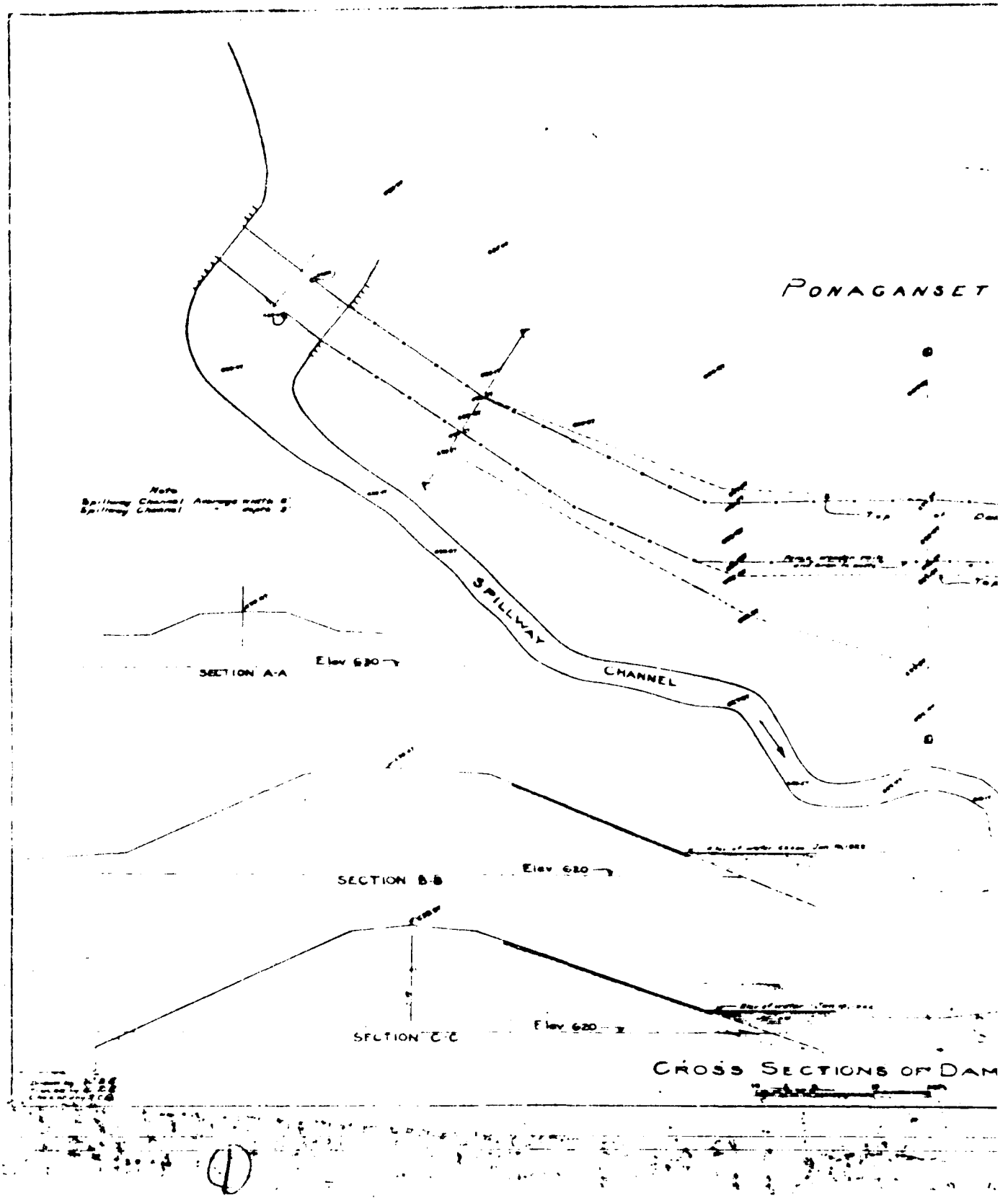
PERIODIC INSPECTION CHECK LIST

PROJECT Ponaganset Reservoir Dam DATE October 30, 1979

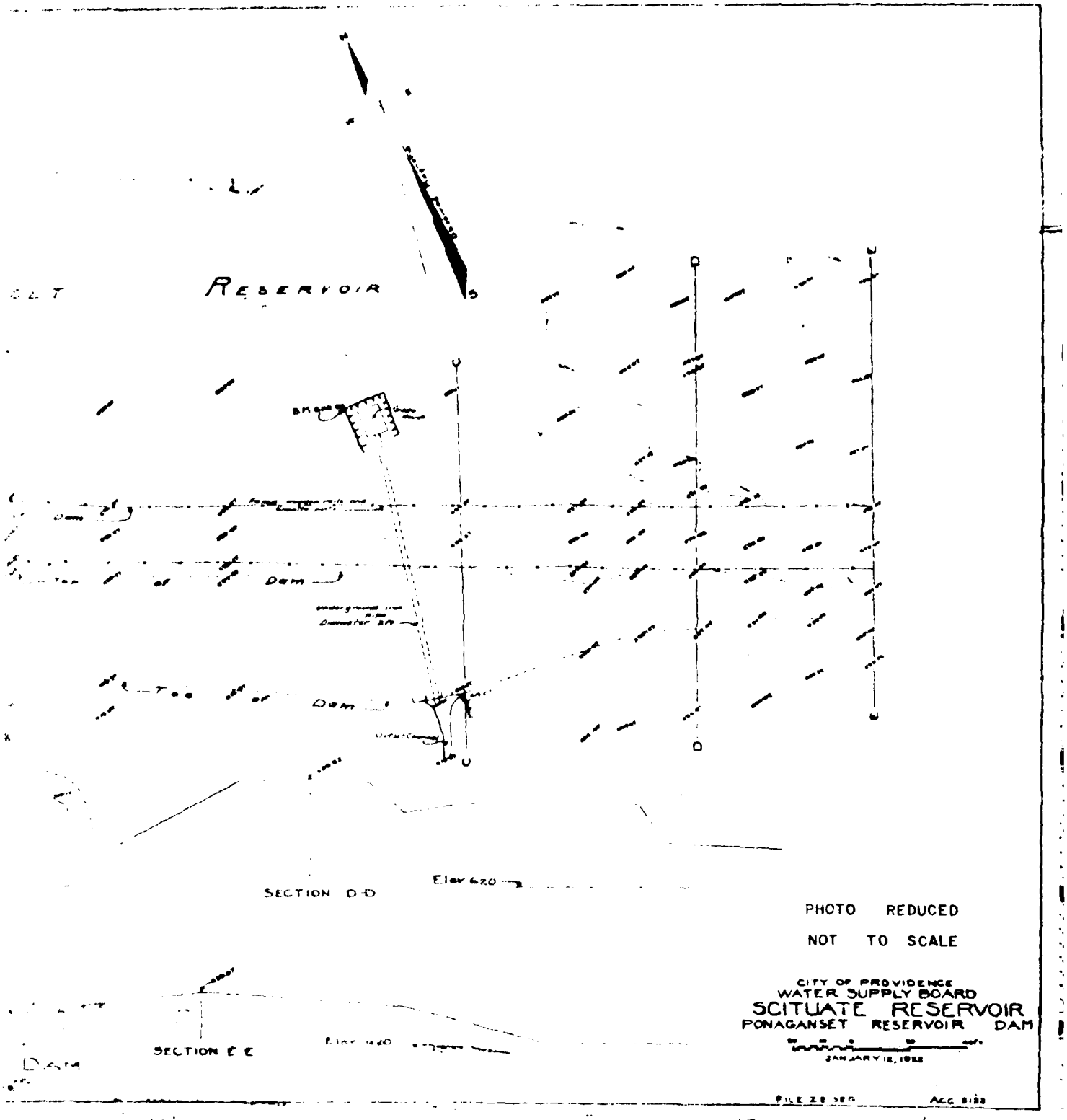
INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

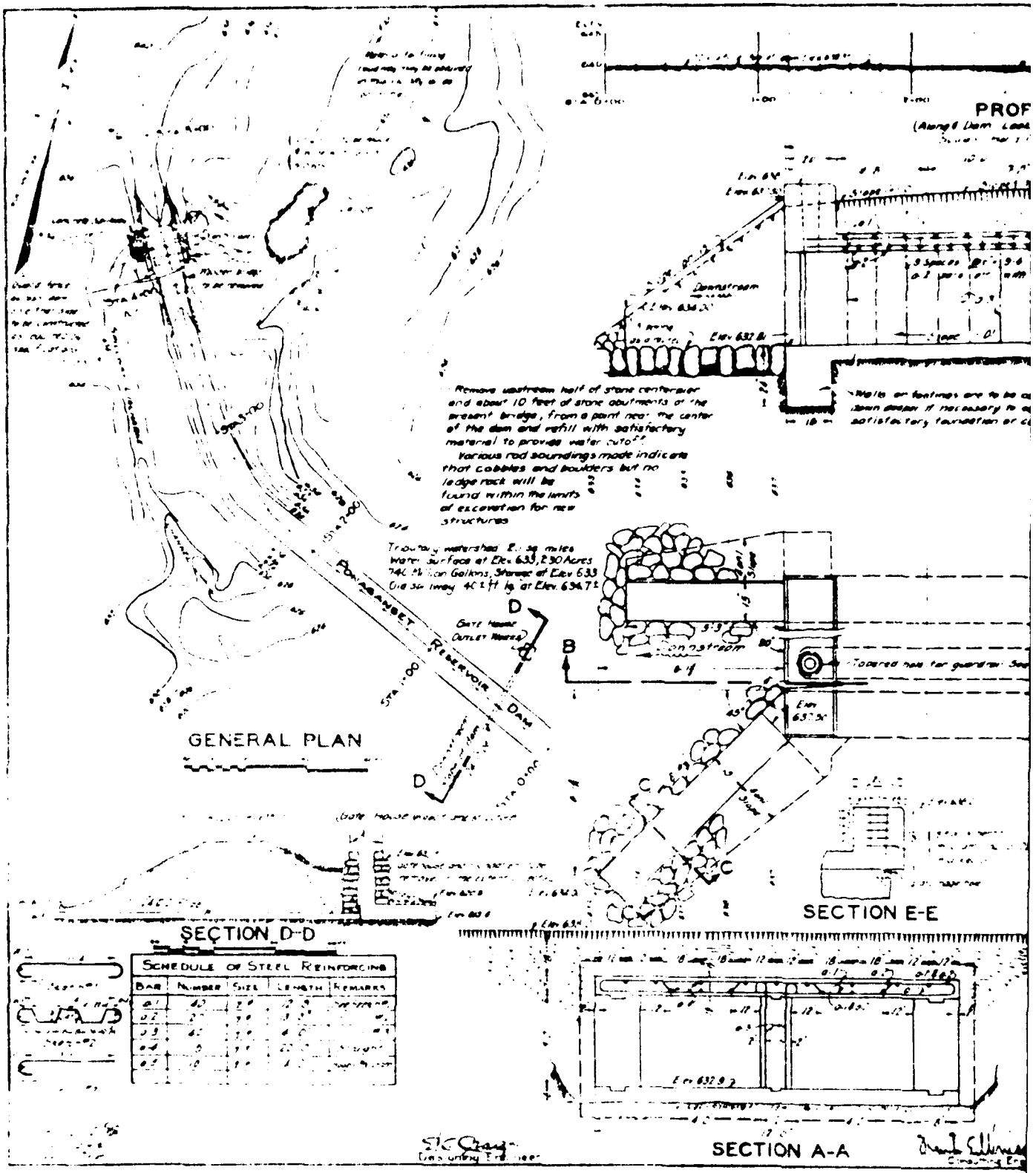
AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Stone masonry headwall, 24 inch dia. cast iron pipe discharging at toe of embankment
Erosion or Cavitation	None observed
Condition at Joints	Open stone masonry
Channel	Grass-lined natural channel
Loose Rock or Trees Overhanging Channel	Several trees overhanging channel
Condition of Discharge Channel	Channel lined with grass and intermittent cobbles; channel restricted (7' width) between abandoned bridge abutments



CROSS SECTIONS OF DAM


RESERVOIR
Dam
Dam
SECTION D-D
Elev 620
PHOTO REDUCED
NOT TO SCALE
CITY OF PROVIDENCE
WATER SUPPLY BOARD
SCITUATE RESERVOIR
PONAGANSET RESERVOIR DAM
JANUARY 12, 1933
SECTION E E
Dam

(2)



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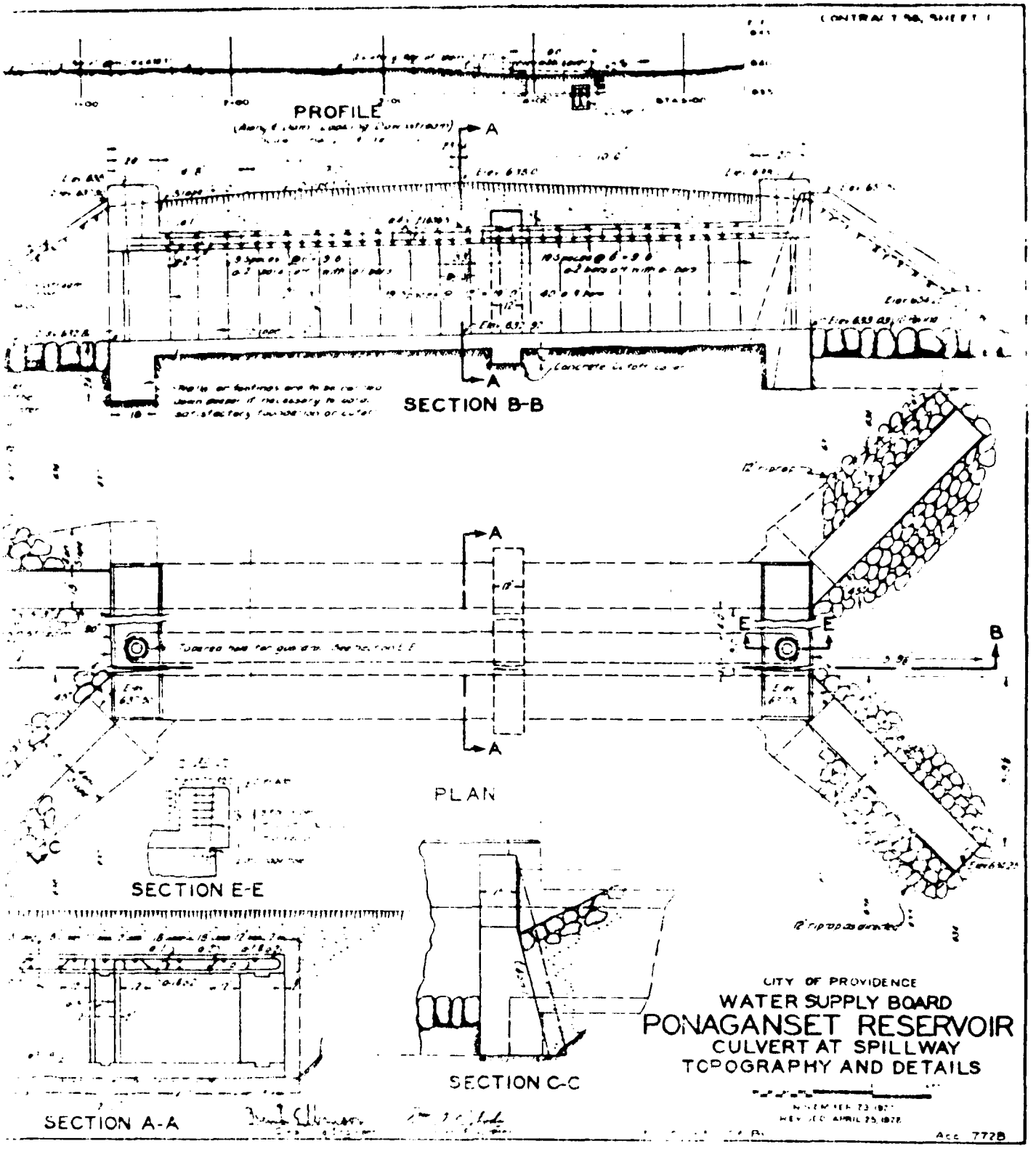
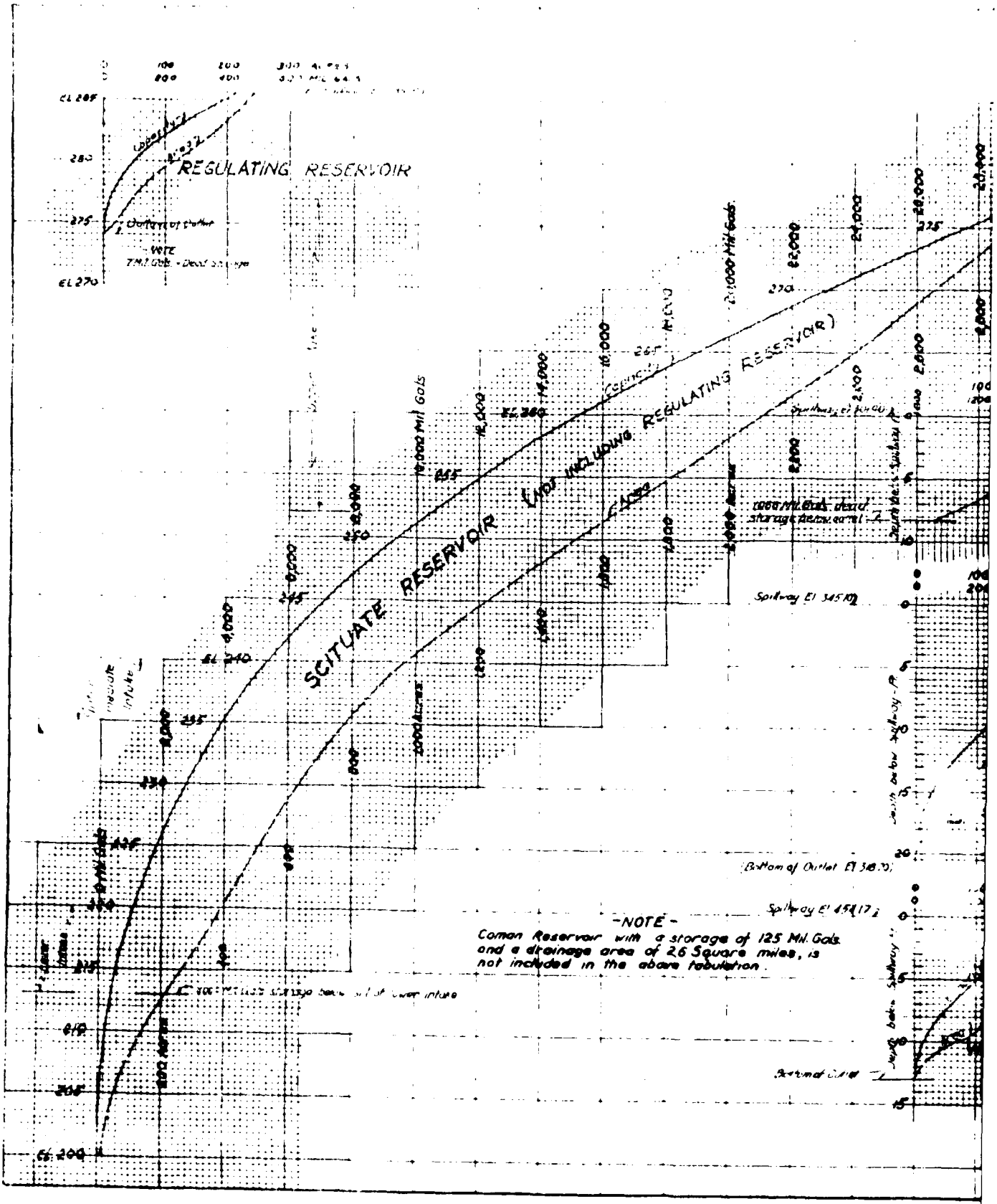
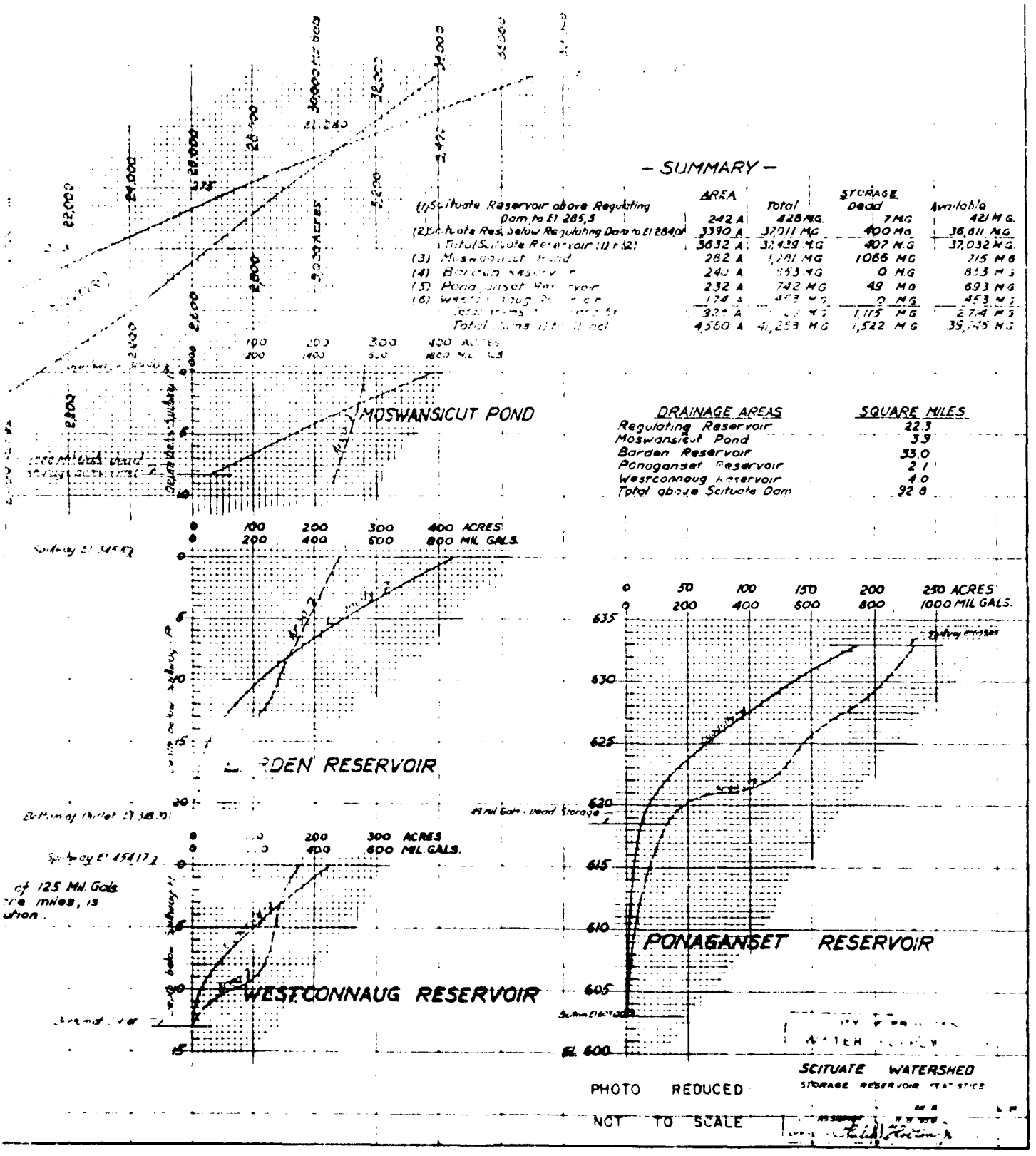

PROFILE
A
A
SECTION B-B
A
PLAN
E
E
B
C
SECTION E-E
SECTION C-C
SECTION A-A
CITY OF PROVIDENCE
WATER SUPPLY BOARD
PONAGANSET RESERVOIR
CULVERT AT SPILLWAY
TOPOGRAPHY AND DETAILS
Acc 7728
REDUCED NOT TO SCALE

(2)

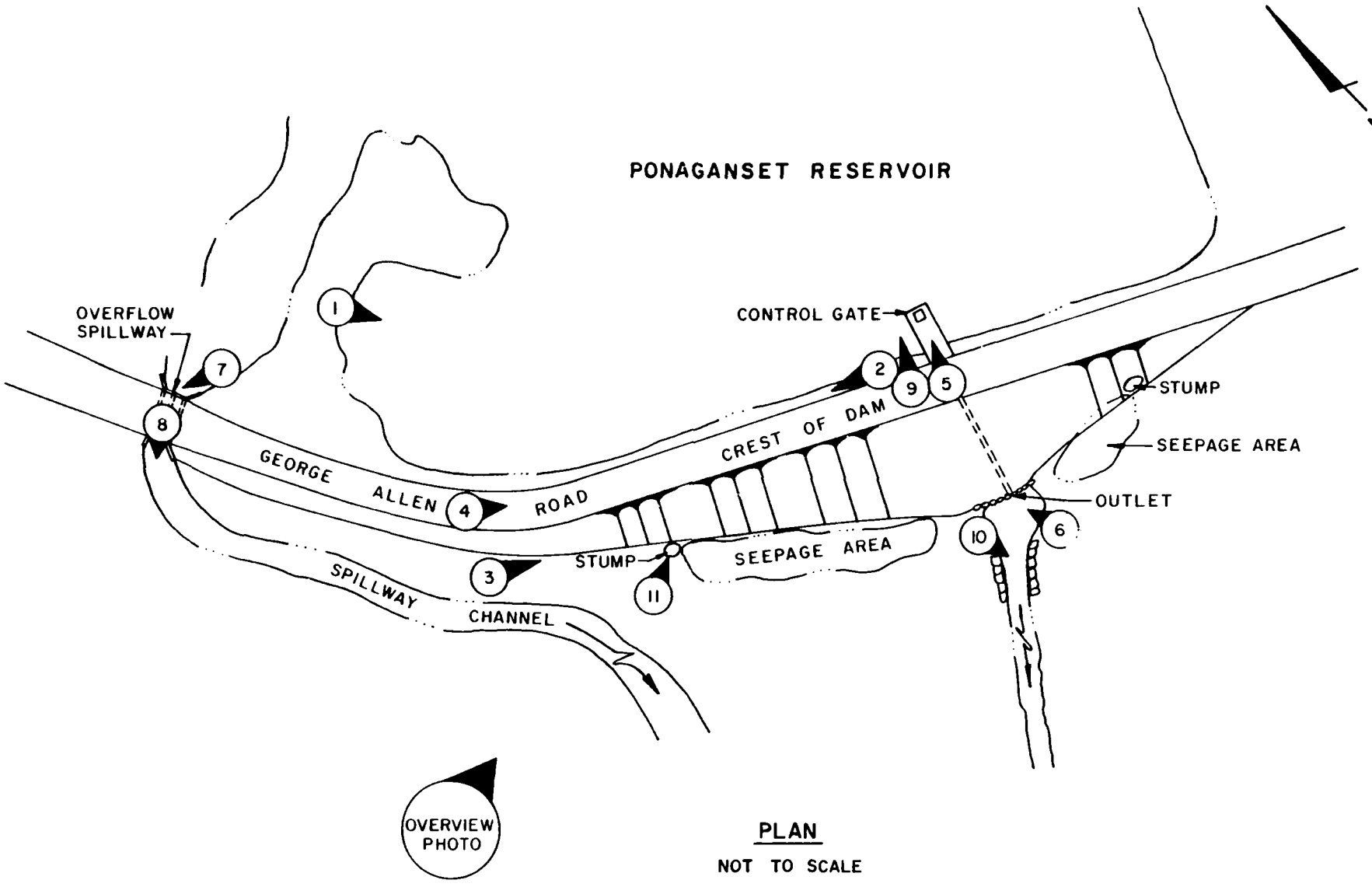

REGULATING RESERVOIR
SCITUATE RESERVOIR
(INCLUDING REGULATING RESERVOIR)
-NOTE-
Comon Reservoir with a storage of 125 MN. Gals. and a drainage area of 2.6 Square miles, is not included in the above tabulation.



(2)

APPENDIX C

PHOTOGRAPHS



PLAN

NOT TO SCALE

PONAGANSET RESERVOIR
PHOTO INDEX

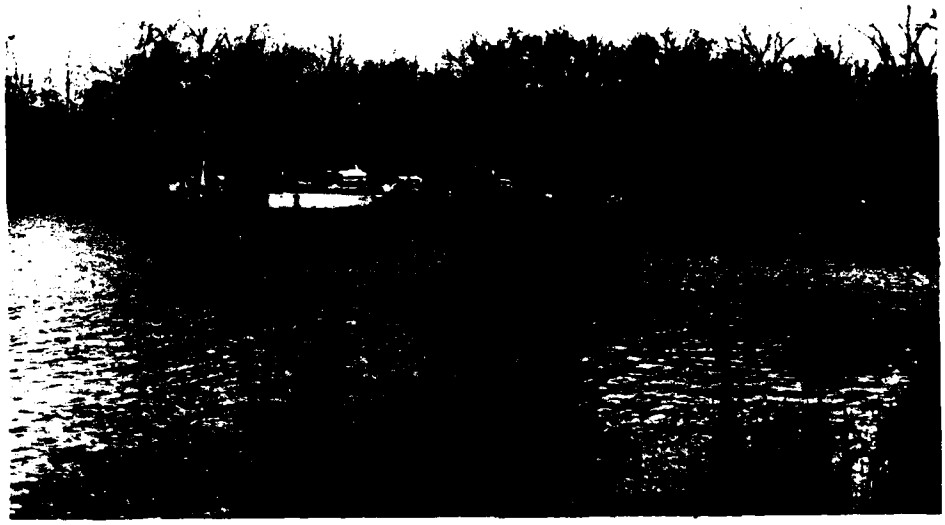


PHOTO C-1 - Upstream Face of Dam looking from right abutment.

PHOTO C-2 - Upstream Face of Dam.

PHOTO C-3 - Downstream Slope of Dam above Outlet Works.

PHOTO C-4 - Crest of Dam looking from Right Abutment.

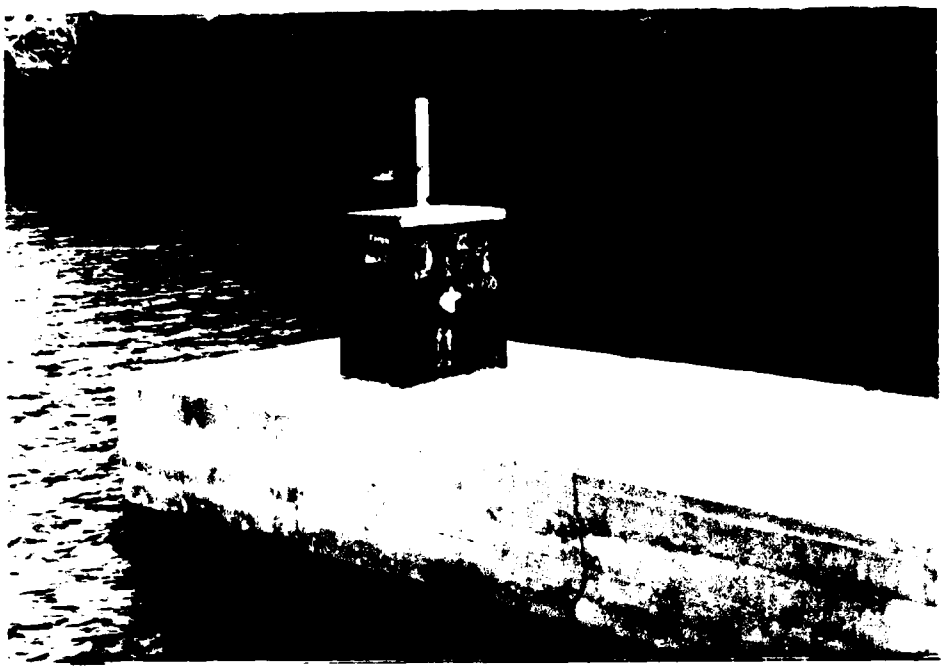


PHOTO C-5 - Outlet works gate control mechanism.

PHCTO C-6 - Outlet works conduit headwall & downstream toe of dam.

PHOTO C-7 - Overflow spillway box culvert beneath George Allen Road.

PHOTO C-8 - Downstream channel below spillway box culvert.

PHOTO C-9 - View of Reservoir from dam.

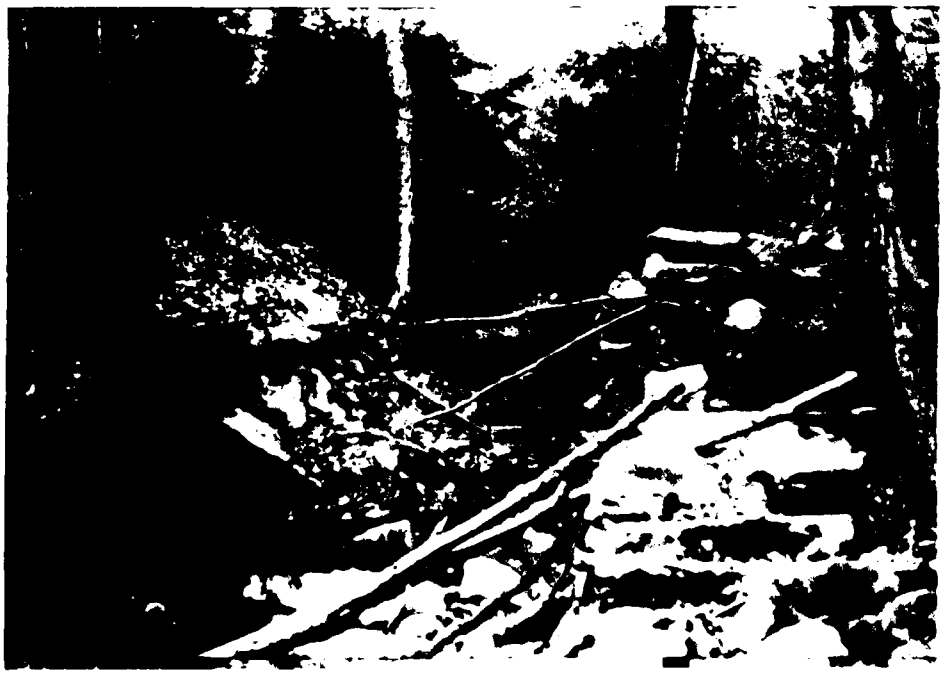
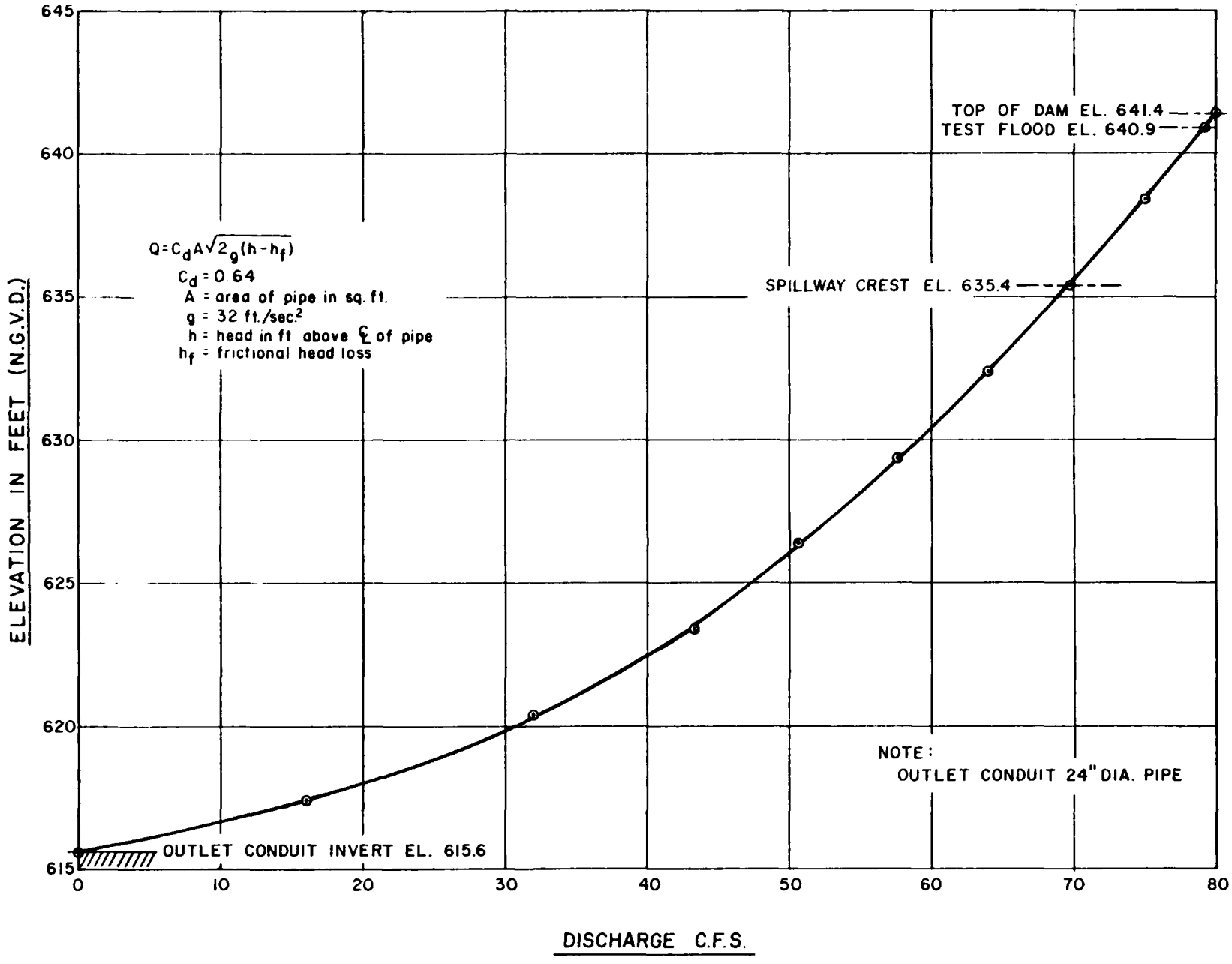


PHOTO C-10 - Downstream channel.

PHOTO C-11 - Stump on downstream slope of dam.

APPENDIX E

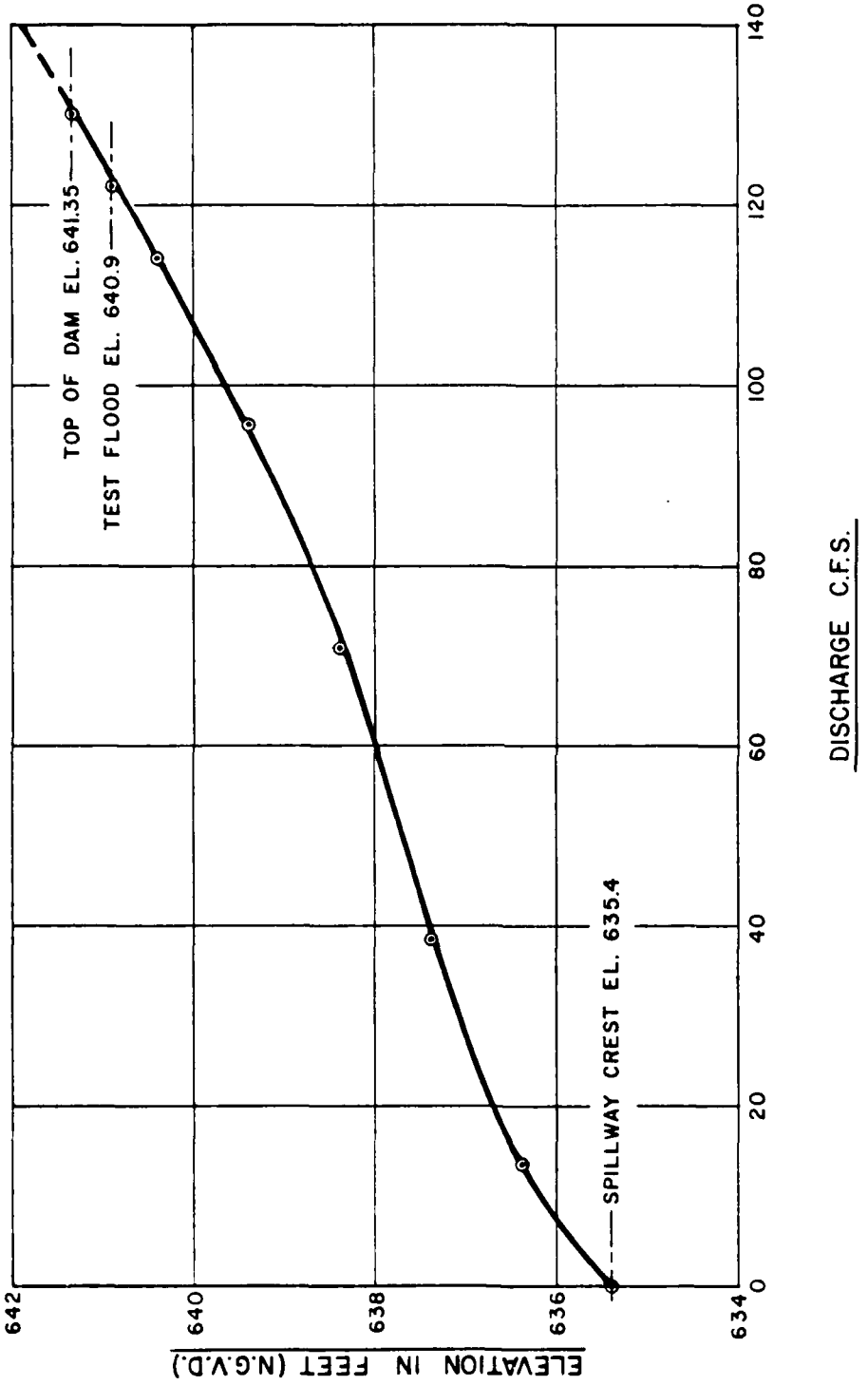
INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS



OUTLET RATING CURVE

PONAGANSET RESERVOIR DAM

PLATE D-12



SPILLWAY RATING CURVE

PONAGANSET RESERVOIR DAM

PLATE D-11

Ponaganset Reservoir Dam

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Spillway width = 2 - 4' x 3' Twin box culvert Spillway crest elevation = 635.4 NGVD

Length of dam = 635.0 feet; Top of dam elevation = 641.4 NGVD

C = 3.0

i) SPILLWAY RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
635.4	0	Spillway Crest Elevation
636.4	13.6	
637.4	38.6	
638.4	70.9	
639.4	95.6	
640.4	114.0	
640.9	122.0	Test Flood Elevation
641.35	130.0	Top of Dam

ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
641.4	80.0	Top of Dam
640.9	79.2	Test Flood Elevation
638.4	75.0	
635.4	69.7	Spillway Crest
632.4	64.0	
629.4	57.7	
626.4	50.6	
623.4	43.3	
620.4	16.0	
615.6	0	Invert of Outlet

Size of Outlet = 24"diameter pipe; Area of Outlet = 3.14 sq.ft.

Invert of Outlet = 615.6 Center Line of Outlet = 616.6

DAM FAILURE ANALYSIS

STEP 5 -

Anticipated adopted minimum wave depth of flow = $d_{minimum}$
$= 0.17\ y_o$ feet = 4.10 feet

Parabolic shaped water surface profile from the dam upto obstruction presumably unwashable 2500 ft. (x_{total}) ft. downstream is computed by and adjusted for possible steady and normal flow depth backup in the below given table.

$$(\tfrac{4}{9} y_o - d_{min.}) \left(\frac{x}{x_{total}}\right)^2 = 0.28\ y_o \left(\frac{x}{x_{total}}\right)^2 \text{ where } x_{total} = 2500 \text{ ft.}$$

Distance from center line of dam = x	$(\frac{x}{x_{total}})^2$	Drop in depth	Water Surface Elevation as Unsteady Flow	Ground Elevation	Normal Depth	Adopted Water Surface Elevation
0	0	0	641.4= Top of dam	--		641.4=Top of dam
0	0	$\frac{5}{9} y_o$ = 13.33 ft.	628.02		d_n	628.02= just D/S of dam Adopt
100	0.0016	0.01	628.01	618.01	10.0	628.02
400	0.025	0.17	627.85	616.15	9.8	627.85
800	0.10	0.63	627.39	611.35	9.6	627.39
1200	0.23	1.55	626.47	610.55	9.4	626.47
1600	0.41	2.75	625.27	605.75	9.2	625.27
2000	0.64	4.30	623.72	600.95	9.0	623.72
2400	0.92	6.18	621.84	596.15	8.8	621.84
2500	1.00	6.72	621.30	591.35	8.6	621.30
3500	1.96	13.17	614.85	575.35	8.4	614.85
4500	3.24	21.77	606.25	559.35	8.2	606.25

Note: Adopted water surface elevation is higher of the two values:

a) Ground Elevation + $\frac{4}{9} y_o$ = drop in depth

OR b) Ground Elevation + d_n

DAM FAILURE ANALYSIS

NOTES:
1. $W_B \leq B$
2. Failure of dam is assumed to be instantaneous when pool reaches top of dam, and is a full depth - partial width rectangular shaped failure.

STEP 1 - Dam Failure Discharge = Q_b

$$Q_b = \frac{8}{27} W_B \sqrt{g}\ y_o^{3/2} \left(\frac{B}{W_B}\right)^{0.25*} = 1.68\ B^{0.25}\ W_B^{0.75}\ y_o^{1.5}$$

$$= 21727 \text{ C.F.S.}$$

* Reference: Research note No. 5, "Guidelines for Calculating and Routing a Dam - Break Flood by the Hydrologic Engineering Center - C.O.E. - January, 1977.

Maximum Spillway Discharge = Q_S = 200 C.F.S.
(C = - B = - H = - ft.) (See Spillway Rating Curve)

STEP 2 - Wave Flow (Unsteady Flow) Characteristics

Depth of flow immediately downstream of Dam = $\frac{4}{9} y_o$ = 10.67 ft.

Velocity of flow immediately downstream of Dam = $\frac{2}{3} \sqrt{g y_o}$

=18.5 ft./sec.

STEP 3 - Adopted minimum possible depth of flow = 0.138 y_o = 3.31ft.
Actual maximum possible velocity of flow = $2\sqrt{g y_o}$ = 55.6ft./sec.
Adopted theoretical maximum possible velocity = $\frac{2}{3}\ 2\sqrt{g y_o}$ = 37.0 ft./sec.

STEP 4 - Normal Flow (typical) Manning's Characteristics

Location of unwashable major obstruction is Route 101 (Hartford Pike)
2500 ft. D/S

S_o = 0.016; "n" = 0.065; Bed width of channel = b = varies
Total failure discharge = $Q = Q_b + Q_S$ = 21927 C.F.S. = 22000 C.F.S.
Normal depth of flow for Q (22000 C.F.S.) = 10.0 feet = d_n
Normal depth of flow for Q (122 C.F.S.) = 2.0 feet = d_n'
Adopted maximum depth is larger of $\frac{4}{9} y_o$ or d_n = 10.67 feet
Adopted increase in depth due to failure of dam $\frac{4}{9} y_o - d_n' - d_n'$ = 8.67 feet
Adopted maximum velocity of flow = $\frac{4}{3}\sqrt{g y_o}$ = 37.0 ft./sec.

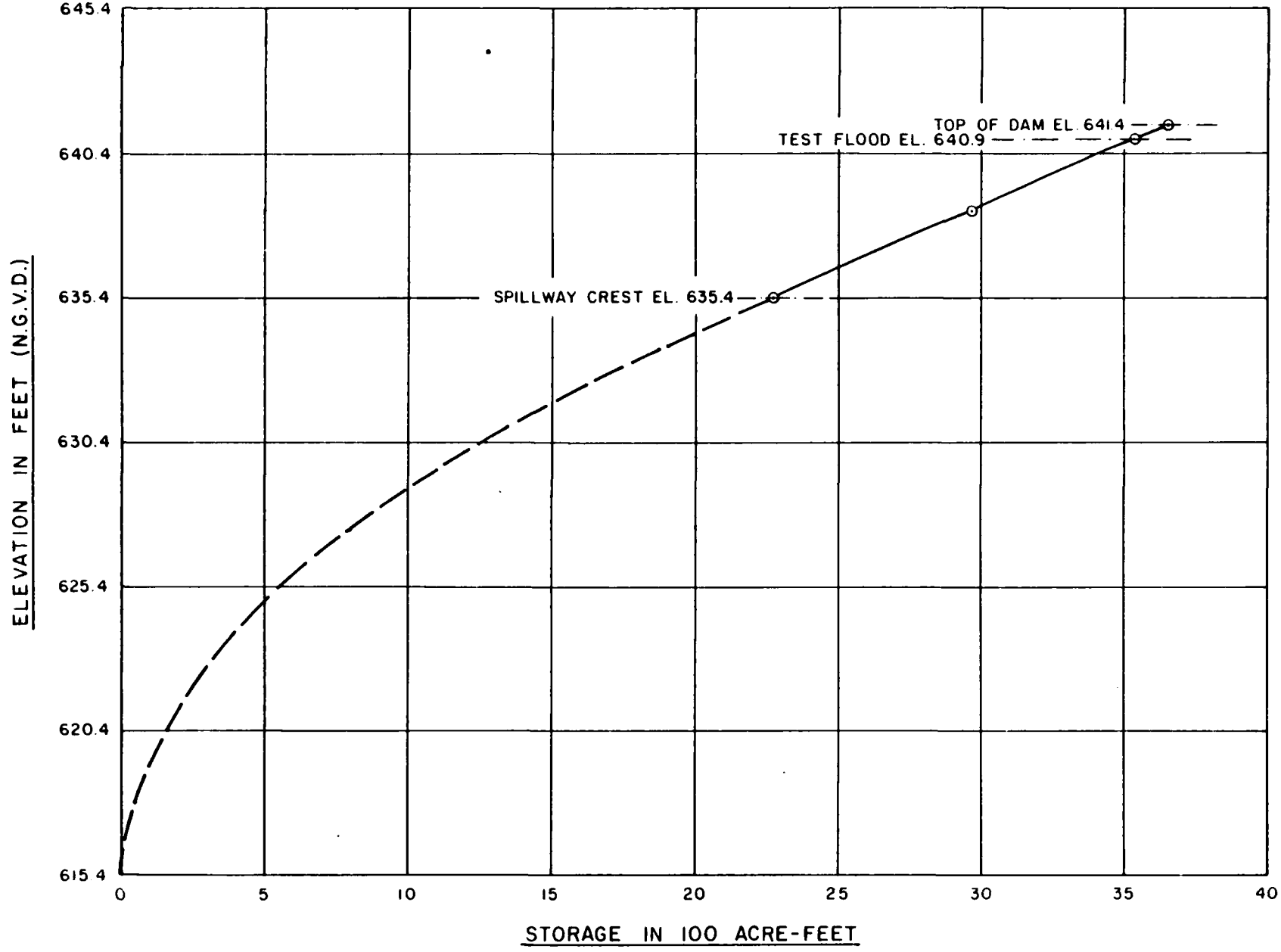
DAM FAILURE ANALYSIS

In addition to energy considerations, the volume of water which is available in the reservoir to sustain the flood wave must be considered. Important energy losses which occur as the flood wave moves downstream include friction losses, bend losses, obstruction losses, expansion and contraction losses, etc. Also the failure discharge and energy losses are reduced by the failure hydrograph being modified with decreasing peak due to available storages downstream. Judgment was used to estimate the most critical situation after the dam failure. Consequently analysis was based upon i) undular wave rather than hydraulic bore; ii) impact of flood wave and the resulting energy loss due to damaged or destroyed structures and sinuosity of the channel were ignored; and iii) the dam failure discharge of 21727 C.F.S. will merge with 122 C.F.S. already flowing through the existing overflow spillway making a total outflow of 21849 C.F.S. It is assumed that prior to failure, the maximum spillway discharge has already substantially filled the available storage areas downstream. In this case large storage areas are not available and no adjustment of outflow discharge is required. At a distance of 2500 feet downstream the Route 101 obstruction and frictional losses will reduce discharge and dissipate wave energy with flow converting back to steady and uniform flow with 8.6 ft. depth following Manning's formulae.

NOTE: --

1. Adopted water surface elevation is higher of the two values:
   a) ground elevation + $\frac{4}{9} y_o$ - drop in depth

   OR b) ground elevation + d_n
2. There are three depths for different characteristics of flow.
   a) Depth of flow immediately downstream of dam for unsteady flow conditions = $\frac{4}{9} y_o$ = 10.67
   b) Normal depth for $Q = Q_{b_1} + Q_S$ value of discharge = d_n = 8.20 feet
   c) Normal depth for $Q_S = d_n^1$ = 2.0 feet
3. Maximum depth is greater of $\frac{4}{9} y_o$ or d_n = 10.67 to 8.20 feet
   Maximum velocity of flow = $\frac{4}{3} gy_o$ = 37.0 ft./sec.
   Increase in depth due to failure = (d_n or $\frac{4}{9} y_o$) - $d^1 n$ = 8.67 to 8.2 feet
   = 8.50 feet



STORAGE-ELEVATION CURVE

PONAGANSET RESERVOIR DAM

PLATE D-6

"Rule of Thumb Guidance for Estimating Downstream Dam Failure Discharge"

BASIC DATA

Name of dam Ponaganset Reservoir Dam Name of town Glocester, R.I.

Drainage area = 2.10 sq. mi., Top of dam 641.4 NGVD

Spillway type = Twin box culvert Crest of spillway 635.4 NGVD

Surface area at crest elevation = 230 Acres = 0.36 sq. mi.

Reservoir bottom near dam = 617.4 NGVD

Assumed side slopes of embankments 2:1

Depth of reservoir at dam site 24.0 = y_o = 24.0 ft.

Mid-height elevation of dam = 629.4 NGVD

Length of dam at crest = 600 feet

Length of dam at mid-height = 552 feet

20% of dam length at mid-height = W_b = 110 feet

Width of channel immediately downstream = B = 110 ft.; Shape of Breach = rectangular

Elevation (NGVD)	Estimated Storage in AC-FT	
617.4	65	
622.4	246	
627.4	798	
632.4	1657	
635.4	2277	Spillway Crest Elevation
638.4	2967	
640.9	3542	Test Flood Elevation
641.4	3657	Top of Dam Elevation

Name of Dam: Ponaganset Reservoir Dam

Estimating Effect of Surcharge Storage on "Test Flood"
[Routing of Flood Through Reservoir]

The routing of floods through the reservoir was carried out according to guidelines established by the Corps of Engineers in Phase-1 Dam Safety Investigations issued March, 1978.

Formulae used were the following for peak inflow = Q_{p1} in C.F.S.

Surcharge height to pass Q_{p1} in feet = $h_1 = \left[\frac{Q_{p1}}{CB}\right]^{2/3}$ ----------(1)

Surcharge storage in inches for surcharge height h_1 = $S_1 = \frac{S.A \times h_1 \times 12}{D.A}$ ---(2)
where S.A = surface area in square miles
where D.A = drainage area in square miles

$$Q_{p2} = Q_{p1}\left[1 - \frac{S_1}{\text{Total Effective Rainfall}}\right] \text{----------(3)}$$

First Approximation

Test flood inflow = Half PMF = Q_{p1} = 1050 C.F.S.

h_1 = 7.0 feet

S_1 = 10.0 inches

Final Approximation

Test flood outflow = Q_{pfinal} = 122 C.F.S.

h_{final} = 5.5 feet

S_{final} = 9.5 inches

In this final approximation, equations (1), (2) and (3) are satisfied by trial and error with total effective rainfall equal to 9.5 inches.

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: October 30, 1979

Name of Dam Ponaganset Reservoir Dam ; Location of Dam Ponaganset River ; Town Glocester, R.I.

Watershed Characterization Largely wooded, rolling terrain; swampy ; 0.21 sq. miles of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = Half PMF = 500 CSM = 1050 CFS; Re = Effective Rainfall = 9.5 inches

D.A. = Drainage Area (Gross) = 2.10 Square Miles; Basin Slope = 0.01 - 0.03 hence; flat to moderate

S.A. = Surface Area of Reservoir = 0.36 Square Miles; Time of Concentration 40 minutes

Shape and Type of Spillway = Twin 4.0'W x 3.0'H culverts

B = Width of Spillway = 8.0 feet; C = Coefficient of Discharge = (0.68-Friction) = 0.64

Maximum Capacity of Spillway Without Overtopping = 130 CFS = 107 % of test flood

Top of Dam Elevation = 641.4 ; Spillway Crest Elevation = 635.4

Overflow portion of Length of Dam = 635 ; C = Coefficient of discharge for Dam = 3.0

Name of Dam	Test Flood Q_p CSM	Test Flood Q_p CFS	Inflow Characteristics h_0 in feet	Inflow Characteristics S_0 in in.	Outflow Characteristics First Approximation Q_{p1} CFS	h_1 in ft.	S_1 in in.	Outflow Characteristics Second Approximation S_2 in in.	h_2 in ft.	Q_{p2} CFS	Outflow Characteristics Third Approximation (Adopted) S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ponaganset Reservoir Dam	100 year =250	525	-	-	-	-	-	-	-	-	4.6	2.50	60
	$\frac{1}{2}$PMF =500	1050	-	-	-	-	-	-	-	-	9.5	5.50	122

Q_p = Discharge; h = Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

A. Size Classification — Ponaganset Reservoir Dam

Height of dam = 26.0 ft.; hence -

Storage capacity at top of dam (elev. 641.4) = 3657 AC-FT.; hence INTERMEDIATE

Adopted size classification INTERMEDIATE

B. Hazard Potential

It is estimated that failure of the dam will result in the loss or damage to George Allen Road, Route 101 (Hartford Pike), Winsor Road and an unnamed secondary road. Utilities within the rights of way for these roadways will also be damaged and temporarily disrupted. It is believed that the loss of a few lives will result.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	INTERMEDIATE	Half PMF to Full PMF

Adopted Test Flood = Half PMF = 500 CSM

= 1050 CFS

D. Overtopping Potential

Drainage Area = 2.10 sq. miles

Spillway crest elevation = 635.4 NGVD

Top of Dam Elevation = 641.4 NGVD

Maximum spillway discharge Capacity without overtopping of dam = 130 CFS

"test flood" inflow discharge = 1050 CFS

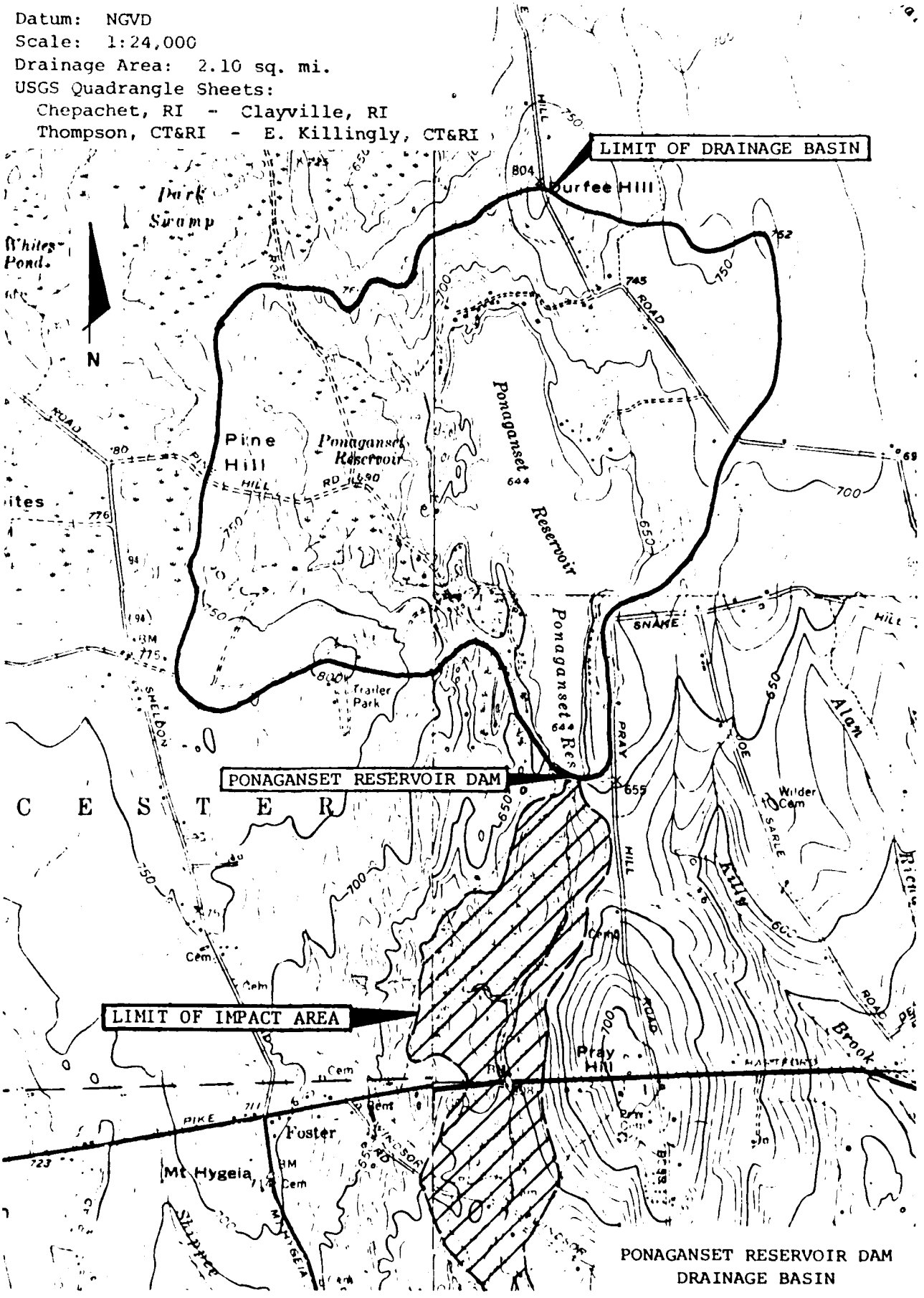
"test flood" outflow discharge = 122 CFS

% of "test flood" overflow carried by spillway without overtopping = 107%

"test flood" outflow discharge portion which overflows over the dam = 0 CFS

% of test flood which overflows over the dam = 0%

Datum: NGVD
Scale: 1:24,000
Drainage Area: 2.10 sq. mi.
USGS Quadrangle Sheets:
Chepachet, RI - Clayville, RI
Thompson, CT&RI - E. Killingly, CT&RI



PONAGANSET RESERVOIR DAM
DRAINAGE BASIN

PLATE D-1

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

NOT AVAILABLE AT THIS TIME

END

FILMED

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